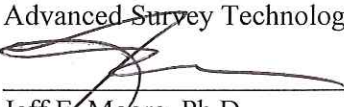## Project Instructions

Date Submitted: 11 June 2018

Platform: NOAA Ship *Reuben Lasker*

Project Number: RL-18-03 (OMAO), 1807RL (FRD), 1651 (MMTD)

Project Title: 2018 California Current Ecosystem Survey (CCES)

Project Dates: 26 June to 23 September 2018

Prepared by: Kevin Stierhoff, Ph.D.
Survey Coordinator, FRD
SWFSC

Prepared by: Annette Henry
Survey Coordinator, MMTD
SWFSC

Approved by: Dated: 6/11/18
David A. Demer, Ph.D.
Chief Scientist, FRD
Advanced Survey Technologies, SWFSC

Approved by: Dated: 6/11/18
Jeff E. Moore, Ph.D.
Chief Scientist, MMTD
California Current Marine Mammal Assessment, SWFSC

Approved by: Dated: 6/11/18
Gerard Dinardo, Ph.D.
Director
Fisheries Resources Division, SWFSC

Approved by: Dated: 6/11/2018
Lisa Ballance, Ph.D.
Director
Marine Mammal and Turtle Division, SWFSC

Approved by: Dated: 6/11/2018
Kristen Koch
Science and Research Director
SWFSC

Approved by: Dated:
Captain Keith W. Roberts, NOAA
Commanding Officer
Marine Operations Center – Pacific

I.   Overview

A.   Brief Summary and Project Period

The 2018 California Current Ecosystem Survey (CCES) is a joint project between the Fisheries Resources Division (FRD) and the Marine Mammal and Turtle Division (MMTD) at NOAA's Southwest Fisheries Science Center (SWFSC). The overarching goal is to survey populations of coastal pelagic fish species (CPS), marine mammals, their prey, and their environment along the West Coast of the U.S. and Vancouver Island, Canada. Each Division has specific, complimentary objectives that are briefly elaborated below.

The primary objectives for the FRD are to survey the distributions and abundances of coastal pelagic fish species (CPS), their prey, and their biotic and abiotic environments in the California Current between the U.S.-Mexico border and the northern extent of Vancouver Island, Canada, 26 June to 23 September 2018.

The primary objectives for the MMTD are to estimate the abundances of whales and dolphins in the U.S. West Coast Exclusive Economic Zone and understand factors that affect their distributions in this area, within 200 nmi of the coasts of Washington, Oregon, and California. Other objectives are to characterize the pelagic ecosystem within the study area, study seabirds, and identify (ID) certain cetacean species using biopsies and photographs.

The survey domain encompasses the anticipated distributions of the northern sub-population of Pacific sardine (*Sardinops sagax*), northern and central sub-populations of Northern anchovy (*Engraulis mordax*), and portions of the stocks of Pacific mackerel (*Scomber japonicus*) and jack mackerel (*Trachurus symmetricus*), and numerous cetacean species. Acoustic and visual transects will be conducted using the following sampling guidelines:

Depart San Francisco, California and transit offshore to the northernmost transect line off Cape Scott, Vancouver Island along the route shown in **Appendix A**. The goal is to sample all of the compulsory transects within the survey footprint (**Appendix A**). Where the compulsory transects have a 20-nmi spacing, adaptive transects will be added if CPS are abundant (see the adaptive sampling protocol in **Appendix B**). The transects will be extended as close to shore as navigable, and as far offshore as necessary to map the western extent of CPS, based on: the presence of CPS eggs in CUFES, CPS echoes in echograms, or CPS in trawl catches. As many as six marine mammal transects will be extended 120 nmi (or 12 h) offshore to survey offshore cetacean species. As many as 2 h per day (on average) will be made available for excursions off the acoustic transects to identify marine mammal groups and estimate group size; to conduct photo ID or biopsy sampling of marine mammals.

Days at Sea (DAS)

Of the 80 DAS scheduled for this project, 80 DAS are funded by a Line Office Allocation according to the Fleet Allocation Plan. This project is estimated to exhibit a high Operational Tempo.

B.   Operating Area

The candidate survey area spans from the northern extent of Vancouver Island, Canada, to the U.S.-Mexico border. Throughout the survey area, transects extend to the 1000 fathom isobaths, but at least 35 nmi offshore, and six will extend 120 nmi to observe marine mammals farther offshore (see **Appendix A**).

C.   Summary of Objectives

Fisheries Resources Division

The primary objectives are to estimate the distributions and abundances of CPS, particularly the northern and central sub-populations of Northern anchovy, the northern subpopulation of Pacific sardine, jack mackerel, Pacific mackerel, their prey, and their biotic and abiotic environments in the California Current.

To achieve these goals, specific activities include:

Continuously sample multi-frequency acoustic backscatter during the daytime (sunrise to sunset) using Simrad EK60, EK80, and ME70. These data will be used to estimate the distributions and abundances of CPS and krill. All echosounders will be synchronized *ca.* hourly to the ship's NTP time server.

In areas with CPS sign, continuously sample acoustic backscatter with the SX90 sonar operating on low power (to avoid cross-talk with the echosounders). Along inter-transect segments, use high transmit power to maximize the detection range of nearshore CPS schools. When schools are potentially within its field of view, record acoustic imagery using the MS70.

Continuously sample pelagic fish eggs using the Continuous Underway Fish Egg Sampler (CUFES) during transits and 120 nmi transects associated. These data will be used to estimate the distributions of Northern anchovy, jack and Pacific mackerel, and Pacific sardine.

Continuously sample sea-surface temperature, salinity, and chlorophyll-a using a thermosalinometer and fluorometer. These data will be used to estimate the physical oceanographic habitats for target species.

Continuously sample air temperature, barometric pressure, and wind speed and direction using an integrated weather station.

Sample profiles of seawater temperature and salinity 1-5 times per transect to 350 m depth, or as close to the seabed as safely possible, using an underway CTD (UCTD) probe mounted on the port side of the ship's stern.

Sample profiles of seawater temperature, salinity, dissolved oxygen and chlorophyll-a to 350 m depth, or as close to the seabed as safely possible, once prior to or during nighttime trawl sampling using the CTD rosette.

Sample fish near the surface using a Nordic 264 Rope Trawl at 3-4 locations selected each night by the CL/CS. The data will be used to estimate the reproductive parameters, distributions, and demographics of sardine, anchovy, and mackerels.

Monitor and record ambient sounds using the ship's hull-mounted hydrophones and scientist's software (PAMGuard) and USB audio interface (Steinberg UR44).

If it does not cause interference in the EK60, EK80, ME70, SX90, and MS70 data, continuously sample profiles of currents using the RDI/Teledyne Acoustic Doppler Current Profiler (ADCP). It is requested that the ship's Survey Technicians (ST) be responsible for ADCP operations.

Marine Mammal and Turtle Division

The primary objectives are to estimate the abundance and to understand factors that affect the distribution of whales and dolphins that are commonly found U.S. West Coast Exclusive Economic Zone –coastal waters off Washington, Oregon, and California out to a distance of approximately 200 nmi.

To achieve these objectives, specific objectives include:

Visual surveys of cetacean distribution, school size, and school composition to determine animal density and population size. Visual surveys for cetaceans will occur during daylight hours.

Skin biopsies of cetaceans for investigations of stock structure and phylogenetic relationships.

Photo identification to document geographic variation in cetacean morphology, pigment patterns, health condition, school composition, and distribution of individual whales.

Deploy Drifting Autonomous Spar Buoy Recorders (DASBRs) – a passive acoustic monitoring device – to assess occurrence of deep-diving whales. Some DASBRs might also be recovered during this project, but most likely all DASBR recoveries will occur on a subsequent *Lasker* survey in early FY19.

During daylight hours, deploy an autonomous acoustic recorder towed approximately 200 m behind the ship to improve identification and abundance estimation for cetaceans through the combination of acoustic and visual data, and to improve the ability to classify vocalizations to species level.

Surveys seabirds to estimate their density and distribution.

Collect eDNA opportunistically.

Opportunistically deploy Sonobuoys to record vocalizations of large whales.

Communicate with a small-boat team (Cascadia Research Collective) who will work in coordination with NOAA Ship *Lasker* to conduct photo ID and biopsy sampling operations of marine mammal groups.

D.   Participating Institutions
Southwest Fisheries Science Center (SWFSC)
Bureau of Ocean Energy Management
U. S. Navy

E.   Personnel transfers
No mid-leg ship-to-shore personnel transfers are planned, but may be required during the survey.

F. Personnel/Science Party
    Leg I: 26 June through 16 July 2018.

#	Name (Last, First)	Title	Date Aboard	Date Disembark	Sex	Affiliation	Nationality	Email
1	Jeff Moore	Chief Scientist/Cruise Leader	24-Jun-18	16-Jul-18	M	SWFSC	USA	Jeff.e.moore@noaa.gov
2	Juan Carlos Salinas	Sr. Marine Mammal Observer	24-Jun-18	30 Sep-18	M		Mexico	
3	Paula Olson	Sr. Marine Mammal Observer	24-Jun-18	10-Aug-18	F	SWFSC	USA	
4	Dawn Breese	Marine Mammal Observer	24-Jun-18	30-Sep-18	F		USA	
5	Chris Hoefer	Marine Mammal Observer	24-Jun-18	30-Sep-18	M		USA	
6	Felipe Triana	Marine Mammal Observer	24-Jun-18	30-Sep-18	M		USA	
7	Jim Gilpatrick	Marine Mammal Observer	24-Jun-18	4-Sep-18	M	SWFSC	USA	
8	Michael Force	Seabird Observer	24-Jun-18	30-Sep-18	M		Canada	
9	David Demer	Chief Scientist/Fishery Acoustician/FRD Leader	26-Jun-18	16-Jul-18	M	SWFSC	USA	David.demer@noaa.gov
10	Kevin Stierhoff	Fishery Acoustician	26-Jun-18	16-Jul-18	M	SWFSC	USA	
11	Dave Griffith	Fishery Biologist	26-Jun-18	16-Jul-18	M	SWFSC	USA	
12	Lanora Vasquez del Mercado	Fishery Biologist	26-Jun-18	16-Jul-18	F	SWFSC	USA	
13	Anne Freire	Fishery Biologist	26-Jun-18	16-Jul-18	F	SWFSC	USA	
14	Megan Human	Fishery Biologist	26-Jun-18	16-Jul-18	F	SWFSC	USA	
15	Kevin Runge	Volunteer	26-Jun-18	16-Jul-18	M	Volunteer	USA	

Leg II: 20 July through 9 August 2018

#	Name (Last, First)	Title	Date Aboard	Date Disembark	Sex	Affiliation	Nationality	Email
1	Jim Carretta	MMTD Leader	16-Jul-18	9-Aug-18	M	SWFSC	USA	Jim.carretta@noaa.gov
2	Juan Carlos Salinas	Sr. Marine Mammal Observer	24-Jun-18	30 Sep-18	M		Mexico	
3	Paula Olson	Sr. Marine Mammal Observer	24-Jun-18	10-Aug-18	F	SWFSC	USA	
4	Dawn Breese	Marine Mammal Observer	24-Jun-18	30-Sep-18	F		USA	
5	Chris Hoefer	Marine Mammal Observer	24-Jun-18	30-Sep-18	M		USA	
6	Felipe Triana	Marine Mammal Observer	24-Jun-18	30-Sep-18	M		USA	
7	Jim Gilpatrick	Marine Mammal Observer	24-Jun-18	4-Sep-18	M	SWFSC	USA	
8	Michael Force	Seabird Observer	24-Jun-18	30-Sep-18	M		Canada	
9	Juan Zwolinski	Cruise Leader/Fishery Acoustician	20-Jul-18	9-Aug-18	M	SWFSC	FN	Juan.zwolinski@noaa.gov
10	Danial Palance	Fishery Acoustician	20-Jul-18	9-Aug-18	M	SWFSC	USA	
11	Amy Hays	Fishery Biologist	20-Jul-18	9-Aug-18	F	SWFSC	USA	
12	Lanora Vasquez del Mercado	Fishery Biologist	20-Jul-18	9-Aug-18	F	SWFSC	USA	
13	Emily Gardner	Fishery Biologist	20-Jul-18	9-Aug-18	F	SWFSC	USA	
14	William Watson	Fishery Biologist	20-Jul-18	9-Aug-18	M	SWFSC	USA	
15	Rachel Pound	Volunteer	20-Jul-18	9-Aug-18	F	Volunteer	USA	

Leg III: 13 August through 31 August 2018.

#	Name (Last, First)	Title	Date Aboard	Date Disembark	Sex	Affiliation	Nationality	Email
1	Lisa Ballance	Cruise Leader	9-Aug-18	31-Aug-18	F	SWFSC	USA	Lisa.ballance@noaa.gov
2	Juan Carlos Salinas	Sr. Marine Mammal Observer	24-Jun-18	30 Sep-18	M		Mexico	
3	Suzanne Yin	Sr. Marine Mammal Observer	10-Aug-18	30-Sep-18	F		USA	
4	Dawn Breese	Marine Mammal Observer	24-Jun-18	30-Sep-18	F		USA	
5	Chris Hoefer	Marine Mammal Observer	24-Jun-18	30-Sep-18	M		USA	
6	Felipe Triana	Marine Mammal Observer	24-Jun-18	30-Sep-18	M		USA	
7	Jim Gilpatrick	Marine Mammal Observer	24-Jun-18	4-Sep-18	M	SWFSC	USA	
8	Michael Force	Seabird Observer	24-Jun-18	30-Sep-18	M		Canada	
9	Josiah Renfree	FRD Leader/Fishery Acoustician	13-Aug-18	31-Aug-18	M	SWFSC	USA	Josiah.renfree@noaa.gov
10	Thomas Sessions	Fishery Acoustician	13-Aug-18	31-Aug-18	M	SWFSC	USA	
11	Bryan Overcash	Fishery Biologist	13-Aug-18	31-Aug-18	M	SWFSC	USA	
12	Emily Gardner	Fishery Biologist	13-Aug-18	31-Aug-18	F	SWFSC	USA	
13	Sherri Charter	Fishery Biologist	13-Aug-18	31-Aug-18	F	SWFSC	USA	
14	Tor Mowatt-Larssen	Volunteer	13-Aug-18	31-Aug-18	M	SWFSC	USA	
15	TBD (Volunteer)	Fishery Biologist	13-Aug-18	31-Aug-18		Volunteer		

Leg IV: 5 September through 23 September 2018.

#	Name (Last, First)	Title	Date Aboard	Date Disembark	Sex	Affiliation	Nationality	Email
1	Eric Archer	MMTD Leader	31-Aug-18	23-Sep-18	M	SWFSC	USA	Eric.archer@noaa.gov
2	Juan Carlos Salinas	Sr. Marine Mammal Observer	24-Jun-18	30 Sep-18	M		Mexico	
3	Suzanne Yin	Sr. Marine Mammal Observer	10-Aug-18	30-Sep-18	F		USA	
4	Dawn Breese	Marine Mammal Observer	24-Jun-18	30-Sep-18	F		USA	
5	Chris Hoefer	Marine Mammal Observer	24-Jun-18	30-Sep-18	M		USA	
6	Felipe Triana	Marine Mammal Observer	24-Jun-18	30-Sep-18	M		USA	
7	Joel Schumacher	Marine Mammal Observer	4-Sep-18	30-Sep-18	M	SWFSC	USA	
8	Michael Force	Seabird Observer	24-Jun-18	30-Sep-18	M		Canada	
9	David Murfin	Fishery Acoustician	5-Sep-18	23-Sep-18	M	SWFSC	USA	
10	Melissa Mayorga	Fishery Acoustician	5-Sep-18	23-Sep-18	M	Volunteer	Mexico	
11	Scott Mau	Fishery Biologist	5-Sep-18	23-Sep-18	M	SWFSC	USA	
12	Bryan Overcash	Fishery Biologist	5-Sep-18	23-Sep-18	M	SWFSC	USA	
13	David Griffith	Cruise Leader/Fishery Biologist	5-Sep-18	23-Sep-18	M	SWFSC	USA	Dave.griffith@noaa.gov
14	Alyssa Mische	Fishery Biologist	5-Sep-18	23-Sep-18	F	Volunteer	USA	
15	TBD (Volunteer)	Volunteer	5-Sep-18	23-Sep-18		Volunteer		

G.   Administrative

Points of contact

FRD

Survey Coordinator: Kevin Stierhoff (831-420-3919); 110 McAllister Way, Santa Cruz, CA 95060
(kevin.stierhoff@noaa.gov)

Chief Scientist: David Demer (858-546-5603); 8901 La Jolla Shores Drive, La Jolla, CA, 92037
(david.demer@noaa.gov)

MMTD

Survey Coordinator: Annette Henry (858-546-5672); 8901 La Jolla Shores Drive, La Jolla, CA, 92037
(annette.henry@noaa.gov)

Chief Scientist: Jeff Moore (858-546-7161); 8901 La Jolla Shores Drive, La Jolla, CA, 92037
(jeff.e.moore@noaa.gov)

FSV Lasker

Ship Operations Officer: LT James Europe (541-272-9094) NOAA Ship *Reuben Lasker*
(OPS.Reuben.Lasker@noaa.gov)

Diplomatic Clearances

This project involves Marine Scientific Research in waters under the jurisdiction of Canada.
Diplomatic clearance has been requested.

Licenses and Permits

This project will be conducted under the following permits and agreements:

a)   California Department of Fish and Wildlife (CDFW) Scientific Collecting Permit No. SC-013886
(issued 30 March 2018; expires April 2021) issued to Kristen Koch.
b)   Marine Mammal Protection Act (MMPA) Letter of Authorization (LOA) for the CA Current (50
CFR Part 219, Subpart A) effective October 30, 2015 (valid through October 29, 2020) issued to
Cisco Werner.
c)   NMFS ESA consult (eulachon, salmon, sea turtles): NOAA Fisheries West Coast Region (WCR)
Endangered Species Act (ESA) Consultation 2015-2455.
d)   ESA Section 10 Scientific Research Permit (19320) for salmon take (valid through 12/31/2020)
issued to Steve Lindley.
e)   Office of National Marine Sanctuaries (ONMS) 304(d) consultation concurrence received by the
SWFSC (Cisco Werner) on March 16, 2015.
f)   NOAA Fisheries WCR Scientific Research Permit (SRP) as specified in 50 CFR 600.745 issued
to David Demer issued on 6/18/2018 (valid through 9/23/2018).
g)   Oregon Department of Fish and Wildlife (ODFW) Scientific Taking Permit 22151 to Gerard
Dinardo issued 6/22/2018 (valid through 9/23/2018).
h)   Washington Department of Fish and Wildlife (WDFW) Scientific Collection Permit for Marine
Fishes (Dinardo 18-153) to the SWFSC valid through 8/31/2018.
i)   Fisheries and Oceans Canada (DFO) license (IGR-448) issued to FSV *Reuben Lasker* on
6/29/2018 to conduct marine scientific research (valid through 7/15/2018).
j)   NMFS Permit No. 19091, issued to Southwest Fisheries Science Center by the National Marine
Fisheries Service, Office of Protected Resources.
k)   FWS Permit No. MB033305-0, issued to Southwest Fisheries Science Center by the U.S. Fish and
Wildlife Service Migratory Bird Permit Office, Region 8.
l)   ONMS Permit No. MULTI-2013-009, issued to Southwest Fisheries Science Center
m)   Fisheries and Oceans Canada (DFO) Marine Mammal License (XMMS 5 2018) issued to Jeff
Moore to conduct marine mammal research (valid through 7/16/2018).

n) CDFW Sec 2081(a) Memorandum of Understanding (MOU) for incidental take of smelt and salmon (valid through 11 April 2021) issued to Kristen Koch at the SWFSC.

o) WDFW Scientific Collecting Permit for Marine Mammals (Moore 18-179) to the SWFSC (valid through 12/07/2018).

II. Operations

The CL/CS is responsible for ensuring the scientific staff are trained in planned operations and are knowledgeable of project objectives and priorities. The CO is responsible for ensuring all operations conform to the ship's accepted practices and procedures.

A. Project Itinerary

Leg 1: June 26: Depart San Francisco, CA

July 16: Arrive Newport, OR

Leg 2: July 20: Depart Newport, OR

August 9: Arrive San Francisco, CA

Leg 3: August 13: Depart San Francisco, CA

August 31: Arrive San Diego, CA

Leg 4: September 5: Depart San Diego, CA

September 23: Arrive San Diego, CA

B. Staging and De-staging

Staging:

April 23-May 7, San Diego, CA, 10th Avenue Marine Terminal

Sampling gear was loaded and securely stowed by FRD and MMTD prior to the start of the Juvenile Rockfish (JR) Survey on 8 May. During this time, FRD installed the EK-MUX, sound velocity profiler, keel camera, and calibrate the EK60 and EK80 echosounders. The Chemistry Lab remains clear and available to the JR team. Also during this time, MMTD configured the flying bridge for marine mammal operations and stowed other gear on the flying bridge.

Assistance from the ship's personnel was required to crane aboard big-eye binoculars and stands, Sonobuoys, and other project supplies to main deck, flying bridge, and bow. The Program requests power, GPS, and data connections on the flying bridge are checked for continuity and are fully functional prior to sailing. Assistance from the ship's ET will be required for setting up flying bridge computers and wireless connections prior to departure.

June 23-26, San Francisco, CA, Pier TBD (forklift/truck access required).

On 24 June (Sunday), additional assistance from the ship's crew will be required to crane-aboard approximately 20 pieces of equipment, including nets, fish boxes, etc. The ship shall be docked at a pier that will allow the transport of this equipment from the delivery truck to the pier.

Prior to sailing the ship's crew will inspect the starboard-side A-frames and associated oceanographic winches, conducting cable and winch for CTD operations, the thermosalinograph, the flow-through Turner 10-AU fluorometer, the Simrad EK60 echosounder, the Scientific Computing System (SCS), the Global Positioning System (GPS) navigational systems, and the scientific freezer to ensure that they are in proper working order. The SeaBird Model SBE9plus CTD/SBE 11plus V2 Deck Unit system and frame will be installed and inspected ensuring that they are operational. Electrical continuity of the A-frame conducting

cable, the winch's slip ring assembly, and connections to the electronic laboratory will be confirmed by the Chief Electronics Technician (ET) before sailing.

August 31-September 5, San Diego, CA, 10th Avenue Marine Terminal

Between Legs III and IV, an acoustic lander will be loaded for deployment near Point Conception during the transit back to the SCB to resume acoustic sampling. Assistance from the ship's crew will be required to crane the equipment aboard (see deployment details in **Section V.A. Supplementary Projects** and lander description and configuration in **Appendix O**).

Echosounder Calibration:
April 23-May 7, San Diego, CA, 10th Avenue Marine Terminal

An acoustic calibration of the EK60 and EK80 echosounders was conducted while the ship was dockside at 10th Avenue Marine Terminal in San Diego prior to the start of the Juvenile Rockfish (JR) survey.

June 23-26, San Francisco, CA

Prior to the survey, an additional calibration may be attempted dockside (if sufficient depth below the transducers) or on anchor in San Francisco Bay at a location TBD. The EK60/80 transducers shall be cleaned upon arrival to San Francisco at the end of the JR survey (see cleaning procedures below).

De-staging:
September 24, San Diego, CA

Acoustic-trawl survey gear will be de-staged at the end of the survey in San Diego, CA. Marine mammal equipment will stay aboard the ship for survey RL-19-01.

C.   Operations to be conducted
Underway Acoustic Sampling Operations
        a)   Scientific Computing System (SCS) Data Collection
The SCS will serve as the main data collection system throughout the survey. Copies of all SCS data will be provided to SWFSC personnel at the completion of the project on a provided hard disk drive (HDD). The following SCS data streams shall be provided by the ET or ST:

        1)   EAL/ZMUX Send SCS Message at 1-s interval
        2)   CUFES Send SCS Message at 1-s interval
        3)   MOA Continuous Event Logs at 30-s interval

        b)   Position and motion data
The ship will ensure that the POS-MV GNSS Azimuth Measurement System (GAMS) is calibrated and that heading data accuracy is less than 0.05 degrees. The ship will record position and motion data from the Trimble/Applanix POS-MV to binary files via Ethernet storage option for the POSPAC data set selection, plus ZDA and UTC NMEA sentences. The ship will supply position and motion data from the POS-MV to all of the scientific sonar systems (EK60, EK80, MS70, ME70, SX90) at a rate of at least 5 Hz, and the ship will ensure that all IMU- and antenna-transducer x-, y-, and z-offset measurements from the most recent ship's survey are installed appropriately to each sonar system. During daytime, from sunrise to 12 pm PST, and from 6 pm PST to sunset, the ST on watch will assist the acousticians to ensure proper function of the acoustic instruments.

        c)   Thermosalinometer sampling
The ship will provide and maintain a thermosalinometer (TSG), which is calibrated and in working order, for continuous measurement of surface water temperature and salinity. A backup unit (calibrated and in working order) will also be provided by the vessel and remain aboard during the project.

d)   Acoustics

Calibration of the Simrad EK60 and EK80 echosounders is typically performed at the beginning of the project (requiring 6-8 hours). It is requested that the transducer faces are cleaned of all barnacles or any other bio-fouling that will potentially hinder the calibration operations and degrade echosounder data, within one week prior to the calibration. The EK60/80 transducer faces may be cleaned from the centerboard chest with the centerboard retracted to the "maintenance" position; the ME70 transducer must be cleaned by SCUBA divers. SWFSC engineers will install a plate with a sound velocity profiler (SVP) and a pan-tilt-zoom (PTZ) camera and conduct measurements of transducer impedance while the transducers are dry. The SVP and PTZ camera will be used to monitor the sound speed, temperature, and pressure at the transducer faces to improve calibration accuracy, and to observe the presence and behaviors of epipelagic animals, respectively. Data from the SVP will be input to the SCS and logged using the Z-MUX software.

Immediately prior to calibration, a CTD will be cast to obtain measures of temperature and salinity versus depth, to calculate mean sound speeds and absorption coefficients. The centerboard will remain in the retracted position. Three motorized downriggers, two on one side of the vessel and one on the other, will be used to swing a 38.1-mm-diameter tungsten carbide sphere beneath the centerboard-mounted transducers. **It is requested that the STs locate all calibration equipment (downriggers, cabling, and spheres) and participate in the calibration procedures for training purposes.**

Throughout the project, EK60 and EK80 echosounders will be operated continuously at 18, 38, 70, 120, 200 and 333 kHz and interfaced to a data acquisition system to estimate the biomasses of small pelagic fish and krill down to at least 600 m depth. Acoustic sampling will occur along planned transects, during daytime beginning at sunrise and ending at sunset. An "EK-MUX" multiplexer will be installed and used to alternate transmissions from the EK60 and EK80 echosounders. The ST, with assistance from the acoustician, will verify the correct date and time on the echosounder computers, track total kilometers surveyed by EK60, EK80, ME70, MS70, and SX90 (facilitated, if possible, by setting the distance log of each echosounder to zero prior to the survey), and submit respective distances to swfsc.ita@noaa.gov within 30 days following the conclusion of the project. These distances are required for environmental compliance as directed by SWFSC's Letter of Authorization for the California Current Research Area, (LOA CCRA -80 FR 58982) under the Marine Mammal Protection Act (valid until 29 October 2020).

Throughout the project, the ME70 multibeam sonar, configured to collect data to 500 m, will be operated synchronously with the EK60/80 echosounders. Data will be logged continuously.

Throughout the project, the MS70 quantitative multibeam sonar, configured to collect data to 250 m, will be operated synchronously with the EK60/80. Operation of the MS70 requires the centerboard to be extended to the "intermediate" position, at least. If possible, lower the ship's centerboard to the intermediate position while exiting San Francisco Bay. Data will be logged intermittently at the discretion of the lead acoustician.

In areas with CPS, the SX90 omnidirectional fish finding sonar will be operated synchronously with the EK60 and EK80 echosounders. Data will be logged at the discretion of the lead acoustician.

An EK60/EK80 Adaptive Logging program (EAL) will be operated continuously to detect the seabed depth and optimize the transmit interval and logging range while avoiding aliased seabed echoes ("false bottoms"). The EAL will provide a pseudo seabed depth telegram to the ship's K-Sync, to adaptively adjust the transmit intervals of the EK60, EK80, ME70, MS70, SX90, and the ADCP.

A "Z-MUX" multiplexer system will periodically measure the impedances of each of the EK60/80 transducers, ambient noise as measured by the EK60/80 echosounders, and the concomitant measurements of environmental conditions collected by the SCS.

Simrad TD50 four-dimensional imaging software may be loaded on a PC in the acoustics lab for real-time viewing of water column and seabed backscatter. This software will be used to visualize EK80, MS70,

ME70, and SX90 in real-time, particularly in nearshore areas where the seabed is in the range of all echosounders.

The most current versions of EK80, MS70, ME70, SX90, and TD50 will be provided to the ship's ET for installation by approximately **20 June 2018**.

An FTP program may be used in conjunction with the ship's VSAT system to telemeter raw and processed echosounder data ashore in quasi-real-time as bandwidth permits.

The instrumented centerboard will be extended to the "intermediate" position (ca. transducers at ~7 m below the surface). Any changes to this depth should be avoided and reported to the acoustic-system operator(s), and the OOD or ST shall record changes in the centerboard position in the SCS (**Button labels: CB Flush, CB Intermediate, CB Extended**). The acoustic-system operator(s) may request that the centerboard is fully extended (ca. transducers ~9 m below the surface) to reduce bubble-generated noise during heavy weather.

The ship will maintain a nominal speed of 10 kn during all daytime (sunrise to sunset) survey operations but vessel speed may be increased to 12 kn during transits between acoustic transects.

The vessel's Simrad ES60 depth sounder and Doppler velocity log (or comparable) may be used minimally at the discretion of the Commanding Officer (CO), but will normally remain off and secured via circuit breaker(s) while underway. The ship shall inform the CL/CS and acoustic-system operator(s) of any use of the vessel's sounders, as it interferes with the signals received on the EK60/80, ME70, MS70, and SX90 echosounders that will be used continuously. The ER60/80 display on the bridge must be a video replicate of the ER60/80 running in the Acoustics Lab. A second instance of the ER60 will conflict with the EAL and cause the EAL, ER60/80, ME70, and MS70 to crash.

  e) Underway CTD (UCTD)

The UCTD ([Teledyne Oceanscience Underway CTD](#)) will be deployed one to five times along each acoustic transect, during the daytime, at locations indicated by the CL/CS (**Appendix H**). The vessel speed during UCTD casts shall be nominally 10 kn, but may be reduced further at the request of the UCTD operator to achieve the desired cast depth. <u>During acoustic transect sampling, UCTD sampling shall take priority over sampling using the towed passive acoustic array</u>. Two persons are required for UCTD sampling. The ST (from sunrise to 12 pm PST, and 6 pm PST to sunset) or acoustician shall handle the deployment and recovery of the UCTD for each cast, with another member of the ship's crew or a member of the scientific party if crew is unavailable. The UCTD will be prepared and downloaded by the acoustician(s). The OOD shall record the time that the UCTD is deployed and recovered in the SCS event logger (**Button labels: UCTD deployed, UCTD recovered**).

To compare results, the UCTD probe will be secured to the CTD/rosette and cast to a depth of 350 m during the first and last transect of the survey, and if possible, during the first and last transect of each Leg. The OOD shall record the time that the UCTD is deployed and recovered in the SCS event logger (**Button labels: CTD deployed, CTD recovered**).

  f) ADCP

The ship's ADCP should be activated by the ST and data logged. Complete system settings will be provided by the oceanographer but will include 5-min averaging of currents, AGC and 4 beam returns in 60 8-meter bins. **The ADCP will be secured during daytime transits and nighttime trawl if it interferes with the EK60, EK80, ME70, SX90, or MS70 data**.

  g) CUFES

The egg pump will be mounted inside the ship's hull drawing water from a depth of 3 m. It is requested that the CUFES intake is cleared from all marine growth prior to departure.

During the survey, the pump will run continuously between stations to sample any pelagic fish eggs. Approximately 640 l min^{-1} is sent through a concentrator, which filters all material larger than 505 µm. The sieved material is then collected and identified. All fish eggs are identified to the lowest taxa, counted and entered into the data acquisition software. Each sample entry is coupled with sea surface temperature, geographical position, wind speed and direction, date and time, and surface salinity. Sampling intervals will be 30-min in duration whenever possible. The CUFES pump shall be configured to report the flow rate in liters min^{-1} (not gallons min^{-1}).

CUFES data should be updated and plotted on a map shared with the acoustics laboratory as often as possible, for use by the CL/CS for determining potential fishing locations or other sampling activities.

Marine Mammal Transect Survey Operations

Cetacean shipboard transects be conducted during transects conducted approximately perpendicular to shore in Eastern Pacific Ocean. Visual teams (cetaceans and seabirds) will be on effort sunrise to sunset. Photo ID and opportunistic biopsy sampling will be conducted from the ship's bow. Visual teams will communicate with an independent small-boat research team, directing them to groups of marine mammals for photo ID and biopsy. DASBRs will be deployed (see **Appendix A** and **I**). Sonobuoys will be deployed opportunistically in presence of large whales. eDNA will be sampled opportunistically.

The following operational plans can be considered only a guide as to how the CS expects the surveys to progress without being able to predict the weather, operational and scheduling problems, and equipment failures. In particular, it should be noted that the amount of time required at each of the working areas is approximate and may be altered based on weather or the progress of the survey.

The CS for the cetacean and ecosystem assessment portion of this survey has the authority to revise or alter the technical portion of the instructions as work progresses, provided that, after consultation with the CO, it is ascertained that the proposed changes will not (1) jeopardize the safety of personnel or the ship, (2) exceed the overall time allotted for the project, (3) result in undue additional expenses, and (4) alter the general intent of the project instructions. In addition, the CS must notify the Director, Marine Mammal and Turtle Division at the earliest opportunity prior to making: (1) deviations from the general project track or area of operations noted in the project instructions, (2) significant changes or additions of research operations to those specified in the project instructions, or (3) port calls not specifically identified in the project instructions.

       a)   Visual Surveys

Line-transect survey methods will be used to collect cetacean and seabird abundance data. A watch for cetaceans will be maintained on the flying bridge during daylight hours by six (6) mammal observers and one (1) seabird observer. Each mammal observer will work in 2-hour rotations, manning each of the following three stations on the flying bridge for 40 minutes: a port side 25 x 150 binocular station, a center-line data recorder position, and a starboard 25 x 150 binocular station. The seabird observer will work in a 2-hour rotation, and search for seabirds using handheld binoculars. The visual team will be in constant communication (via satellite phone, cell phone, and VHF radio) with an independent small-boat research team from Cascadia Research Collective, who will coordinate with NOAA Ship Lasker to find groups of marine mammals (especially large whales) to conduct photo ID and biopsy sampling.

Ship Speed, Order of Operations: During shipboard cetacean and seabird visual surveys, search effort should start on a trackline determined in advance in consultation between the CS and the Command. The Lasker should travel at 10 kn (speed over ground) along the designated trackline. While on search effort, if the ship's speed over ground should deviate from this by more than 1 kn, the bridge personnel will notify the mammal team on watch or the Cruise Leader.

On sighting a cetacean group or other feature of biological interest, the CL (or Marine Mammal Team Leader or observer team on watch, if the CL is not a member of the Marine Mammal Team) that the vessel be maneuvered to approach the group or feature for investigation. Biopsy and photography operations may

commence from the bow, based on directions from the Marine Mammal Team Leader or Mammal Observers.

It may occasionally be necessary to divert the ship's course from the established trackline during regular effort due to glare or adverse sea conditions. Under these circumstances, the ship may "break transect" and, under the guidance of the CL or senior Marine Mammal Observers, divert its course as necessary to better identify the origin of sightings. When the observers have completed scientific operations for the sighting, the ship will return to the transect at a location prior to the break point to allow acoustic sampling to resume along the transect with no gaps. The duration of the diversions should not exceed 2 h per day, on average.

Ship Equipment Required: The observation computers will be hooked up to the ship's global positioning system (GPS; for course, speed, and position information) and Scientific Computer System (SCS; for weather and heading information) via CAT5 cables. The observation computer systems will require a minimum of (2) CAT5 cables that connect the Flying Bridge to the Acoustics Lab. If the SCS goes down for any reason, the ship's ET or ST must manually restart the WINDACS event (in addition to the other events). A log of observation conditions, watch effort, sightings, and other required information will be entered into the observation computer. Please note that it is very important that all science computers be connected to the same ship GPS.

During the 2017 marine mammal survey on *Lasker*, the S-band radar interfered with scientific equipment on the flying bridge. When the visual observers are working on the flying bridge, the S-band radar should be secured. If the bridge requires its use, the scientists on the flying bridge should be notified.

Ship Personnel Requirements: Weather permitting, the observer team on the flying bridge will conduct visual watches for cetaceans and seabirds during all daylight hours (from sunrise to sunset). The CO shall ensure that the flying bridge work area is free of tobacco smoke at all times when observers are on watch.

b) Passive Acoustics (day or night)

Drifting Autonomous Spar Buoy Recorders (DASBRs) Deployment: Fifteen (15) DASBRs are planned to be deployed during Legs 1 through 4 (see **Appendix A** and **I**). Retrieval and redeployment of recovered units are not planned, but some might take place on Legs 2 through 4. DASBRs consist of a black ABS spar buoy, bungee and nylon line, a submerged recorder and hydrophone system, an 11" sub-surface buoy, and a 30-lb weight at 100-150 m depth (**Appendix M**). The spar buoys will be attached to a secondary round buoy using a 10 m floating line to aid in detection and retrieval. Buoys will include an Iridium or SPOT geo-locator (inside the spar buoy) and will be marked with reflective tape. DASBRs will be deployed and retrieved during the survey by a member of the scientific team and a member of the ship's crew (**Appendix N**). Deployment will be from the stern of the vessel at a vessel speed no greater than 1.5 kn or speed necessary to achieve minimal steerage. This will require communication with the bridge immediately prior to deployment to discuss expected drift and preferred location of deployment. Deployments and retrievals (if they occur) are expected during both day and night, however trawl sampling will have priority over DASBRs retrieval or deployment during nighttime. Retrieval of buoys will be from the side station and will require assistance from ship's crew. Ship's crew will be in charge of using grappling hooks. A 12-volt line-puller may be used to aid retrieval. Buoys will be tracked with a satellite geolocator. During daytime, they will be re-located visually with the assistance of observers on big-eye binoculars (typically at 5 nmi range). At night, they will be re-located visually using the ship's spotlight and reflective tape on the buoys (typically at 0.5 nmi range). Deployment and retrieval (once buoys are located) should each require approximately 30 minutes. DASBR retrieval requires the scientists to work with the deck crew to establish the best method of grappling for the line between the spar buoys and the orange floats. Extreme care is needed to ensure that the vessel does not drift over the top of the line. If the buoy lines are fouled under the ship, try to grapple for the line on the opposite side of the ship and, if necessary, cut the line to retrieve the instruments. The OOD or ST shall record the time of DASBR deployment or retrieval in the SCS event logger (**Button labels: DASBR deployed, DASBR retrieved**).

Sonobuoys: Sonobuoys will be deployed opportunistically in the presence of large whales when time permits. The Cruise Leader or Sr. Marine Mammal Observer will contact the bridge to ask permission to deploy the Sonobuoy prior to deployment. The OOD or ST shall record the time of Sonobuoy deployment in the SCS event logger (**Button labels: Sonobuoy deployed**).

Towed Acoustic Recorder: During daylight hours, an autonomous acoustic recorder will be towed approximately 200 m behind the ship. The instrument package will include a Soundtrap ST4300 recorder and two HTI-96-min hydrophones inside a streamlined tow body (10 cm diameter x 1.2 m length). The instrument will be deployed from the stern on the starboard side each day before marine mammal operations begin and will be retrieved each night after marine mammal observations have ended. Line will be deployed and retrieved by hand (without winch) at steerage speed. Data will be downloaded once per week by the cruise leader or marine mammal personnel. The OOD or ST shall record the time of towed array deployment or retrieval in the SCS event logger (**Button labels: towed array deployed, towed array retrieved**).

Ship Speed, Order of Operations: The Cruise Leader or Sr. Marine Mammal Observer will contact the bridge to ask permission to deploy the Sonobuoy. A chronological record of Sonobuoy deployments will be kept by the ship with locations, dates, and times using SCS.

c)   Oceanography

A chronological record of oceanographic stations will be kept by the ship with locations, dates, and times using SCS. The ship will provide a copy of SCS data and the Weather Log to the CS at the completion of the project.

Thermosalinograph (TSG) Sampling: The ship will provide and maintain a thermosalinograph (TSG) for continuous measurement of surface water temperature and salinity. The TSG will continuously collect surface water temperature and salinity from the ship's clean seawater system.

CTD Sampling (if Underway CTD cannot be used): Data collected using during daytime UCTD casts and nighttime CTD casts to 350 m will be provided to all in the scientific party. CTD/rosette casts will also be made, at the discretion of the CL/CS, in the event of problems with the underway CTD system. For each sample, the CTD/rosette shall be lowered to approximately 350 m (or to within ~10 m of the seabed when the seabed depth is < 350 m) at each station to measure temperature, salinity, oxygen, and chlorophyll-a. The OOD or ST shall record the time that the CTD is deployed and recovered in the SCS event logger (**Button labels: CTD deployed, CTD recovered**).

Ship Equipment Required: The main Sea-Bird CTD system will be provided, maintained, and operated by the ship's ST. All instruments, their spares, and spare parts provided by the ship must be maintained in working order and, if applicable, have current calibrations (within the previous 12 months).

Ship Personnel Requirements: The ship's ST will be responsible for the CTD operations and maintenance. The ship's personnel will operate the operate winch and other deck equipment needed for deployment and retrieval. The Ship's ET will be responsible for the termination (and any necessary re-terminations) of the CTD cable pigtail to the conducting cable of the winch.

d)   Salvage of Marine Mammals, Birds, and Turtles

Marine mammal body parts and/or birds and/or turtles may be salvaged on an opportunistic basis at the discretion of the Cruise Leader. This includes whale and dolphin ivory and carcasses, and whole bird or turtle specimens. In the event that this occurs, scientific freezer space will be used to store the salvaged material. Permits to salvage and import marine mammal parts and birds or turtles will be present on the vessel. All marine mammal specimens obtained will be archived at the SWFSC but may be released on extended loan to recognized research institutions according to existing guidelines.

Standard Daytime Station Sampling Operations

No standard daytime station operations are planned. Unplanned daytime station work may occur at the discretion of the CL/CS and may include hand-line fishing for CPS and camera deployments.

Standard Nighttime Station Sampling Operations

Each standard nighttime station will include the following:

> 1) Surface trawls
> 2) Bongo net tow

> a)   Surface trawling

Two to four surface tows will be conducted each night. The first set will be approximately one hour after sunset, and the last set will be concluded prior to sunrise. Trawl locations will be determined based on CPS egg density, daytime CPS backscatter, and other factors. In accordance with the CDFW Scientific Research Permit (SRP), no trawling shall occur in any CA marine protected areas (MPAs).

Each trawl tow will be fished on the surface for a 45-min duration at a towing speed of approximately 3.5-4.5 knots. The duration of trawls shall be reduced only when necessary to avoid protected species or ensure the safety of the ship or its crew, in which cases a minimum duration of 45 min is preferred but may be reduced at the discretion of the CL/CS. In an attempt keep the footrope from sinking too deep during deployment, it is requested that once the tom weights are in the water, the ship's speed is increased to 3.0-3.5 knots. The catch from each tow will be processed according to the SFWSC mid-water trawl sampling protocol (**Appendix K**). The acoustic trawl mensuration system (Simrad ITI) will be used to monitor the performance of the trawl net, but shall be secured when not in use to avoid interference with the scientific echosounders. The Simrad ITI equipment shall be in working order and available for use throughout the survey. In past surveys, disturbance from the propeller, propeller wash, or both has limited the ability of the trawl mensuration system to monitor nets towed at or near the surface. Scientists from the trawl and acoustics team will work with the deck crew to determine a sensor configuration that provides the best data possible.

When possible (weather permitting), a trawl catch greater than five baskets will be lifted on to the sorting table with the ship's crane. Smaller catches can be dumped into either plastic trash cans or a fish tote.

During trawl operations, when large catches are present, the ST on watch shall assist by recording data, sorting the trawl catch, or both as needed (per **Appendix K**) if it does not conflict with other pertinent duties.

The OOD or ST shall record shall record the time of station arrival and departure in the SCS event logger (**Button labels: Arrive Station, Depart Station**) and the time that the trawl is deployed and recovered (**Button labels: Shoot Doors, Net in Water, Begin Fishing (EQ), Haul Back, Net on Deck**).

It is requested that the OOD note the locations and times when the acoustic sampling starts and stops each day in the SCS event logger (**Button labels: Resume Transect, Break Transect**) and for each transect (**Button labels: Start Transect, End Transect**). After the last trawl of each night or 30 min prior to sunrise, the ship will return to the exact location where the acoustic sampling stopped the previous day, and resume acoustic sampling.

> b)   CTD Sampling

CTD/rosette casts will also be made, one per night (typically before or after the first trawl of the evening), at the discretion of the CL/CS. For each sample, the CTD/rosette shall be lowered to approximately 350 m (or to within ~10 m of the seabed when the seabed depth is < 350 m) at each station to measure temperature, salinity, oxygen, and chlorophyll-a. The OOD or ST shall record the time that the CTD is deployed and recovered in the SCS event logger (**Button labels: CTD deployed, CTD recovered**).

c)	CalBOBL (CalCOFI Bongo Oblique) Sampling

CalBOBL samples will be collected only during the station work at night. Each sample shall be a standard oblique plankton tow with 300 m of wire out, depth permitting, using paired 505 µm mesh nets with 71-cm diameter openings. The tow requires a descent wire rate of 50 m min^{-1} and an ascent wire rate of 20 m min^{-1}. All tows with ascending wire angles lower than 38° or higher than 51° in the final 100 m of wire will be repeated. Additionally, a 45° wire angle should be closely maintained during the ascent and descent of the net frame. The port side sample will be preserved in buffered ethanol at every station. An additional bongo tow will be taken at night in conjunction with the trawling operations, whether the ship is occupying a station or not.

The OOD or ST shall record shall record the time that the bongo is deployed and recovered in the SCS event logger (**Button labels: Bongo IN, Bongo OUT**).

d)	Weather observations

Routine weather observations will be made using the standard SWFSC procedure during every net tow and trawl event (i.e., at every "order occupied").

Other sampling gear

The SWFSC deploys a wide variety of gear to sample the marine environment during all of their research projects. These types of gear are not considered to pose any risk to protected species and are therefore not subject to specific mitigation measures. However, the OOD and crew monitor for any unusual circumstances that may arise at a sampling site and use their professional judgment and discretion to avoid any potential risks to protected species during deployment of all research equipment.

Protected Species Watches

For the nighttime trawl operations, protected species (e.g. marine mammals and turtles) watches are now a standard part of conducting fisheries research activities, particularly those that use gear (e.g., long-lines and mid-water trawls) known to interact with protected species or that we believe have a reasonable likelihood of doing so in the future.

a)	30-min pre-set protected species watches

Protected species watches (visual observation) will be initiated by a designated person/s from the science party no less than 30 min prior to deployment of gear for sampling in order to determine if any protected species are near the proposed trawl set location. This watch can occur during transit leading up to arrival at the sampling station. If stations are less than 5-nmi apart (or less than a 30-min transit time at typical transit speed) then pre-set watch should be conducted for the duration of the transit. Upon arrival at a sampling station, trawl operations shall be conducted immediately except when it is necessary to conduct a bongo plankton tow or CTD deployment prior to deploying trawl gear. Protected species watches will be conducted using any binocular or monocular sighting instrument, with a means to estimate the distance to protected species during the daytime. During nighttime operations, visual observation shall be conducted using the naked eye and available vessel lighting.

b)	Move-on rule

If marine mammals, sea turtles or other protected species are sighted within 1 nmi of the planned set location prior to setting the gear, the vessel will transit to a different section of the sampling area to maintain a minimum distance of 1 nmi between the set location and estimated location of sighted protected species. If, after moving on, protected species remain within the 1-nmi exclusion zone, the CL/CS or watch leader may decide to move again or to skip the station, but in any case, may not set while protected species are in the 1-nmi exclusion radius.

c)	Monitoring during trawl deployment, fishing, and retrieval

In addition to the 30 min protected species watch, visual monitoring efforts for protected species are required throughout the entire period of time that trawl gear is in the water. These watches will occur from deployment through gear retrieval and will be conducted by the watch leader, CL/CS, or other designated

person/s. If protected species are sighted before the gear is fully retrieved, the most appropriate response to avoid incidental take will be determined by the professional judgment of the CL/CS, watch leader and other experienced crew as necessary. This judgment will be based on his/her past experience operating gears around marine mammals and SWFSC training sessions that will facilitate dissemination of CL/CS expertise that is used when operating in these situations (e.g., factors that contribute to marine mammal gear interactions and those that aid in successfully avoiding these events). These professional judgment decisions will be recorded in the provided visual monitoring watch logs. If trawling efforts have been suspended due to the presence of marine mammals, trawl operations may only resume when sighted protected species are estimated to be at least 1 nmi away from the trawl set location. If mammals are observed in or near the net, the trawl survey lead or CL/CS may request immediate retrieval of the net which should be done as rapidly as safely possible so as to prevent lethal takes.

d) Data collection for visual watches

The visual monitoring watches (from 30 min prior to set through gear retrieval) and any data gathered during these watches will be recorded in the watch logs provided for each survey and in the SCS.

e) Marine mammal excluder device (MMED)

At all times, Nordic 264 trawl nets must be fitted with a marine mammal excluder device to allow marine mammals caught during trawling operations an opportunity to escape.

f) Acoustic deterrent devices

Pingers must be deployed during all trawl operations and on all types of trawl nets. Two to four pingers (3 kHz @ 135 dB, 10 kHz @ 132 dB, and 70 kHz @ 145 dB) will be placed along the footrope and/or headrope and will be tested at the conclusion of every trawl to check if they are operating properly – pinger function will be noted in the data collection watch logs.

g) Other standard trawl survey protocols

The gear will be emptied as quickly as possible upon retrieval in order to determine whether or not protected species are present.

Care will be taken when emptying the trawl to avoid damage to protected species that may be caught in the gear but are not visible during retrieval.

h) Reporting, Data Collection, and Handling Procedures for Protected Species

All protected species (marine mammals, sea turtles, seabirds and fish) lethal and non-lethal interactions with fisheries research gear will be reported to the SWFSC Environmental Compliance Specialist through the Incidental Take Authorization (ITA) SWFSC.ITA@noaa.gov account. These interactions will be relayed to the SWFSC Director and recorded in the Protected Species Incidental Take Database within 48 hours of the event.

Catch of eulachon and salmon will only be reported to SWFSC.ITA@noaa.gov at the conclusion of every survey day; no call is necessary. Appropriate communications on all authorized takes will occur in a timely manner to allow the ITA coordinator to report the event to the PSIT in the required 48 hours.

i) Lethal take of marine mammal or sea turtle

If a lethal take of a marine mammal or sea turtle occurs, priority should be placed on removing animal from gear as quickly and safely as possible so photographs and measurements can be taken according to protocol (PSIT-002.02; **Appendix L)** and then the animal should be wrapped in bag/s (trash bags or provided body bag) and placed in the scientific freezer. Concurrently, as stated above, the ITA coordinator should be notified immediately.

j) Non-lethal take of any protected species

Priority for any non-lethal take is to release the animal as quickly as possible according to (3) Protected Species Handling instructions (below) to maximize the chances of post-release survival. First and foremost,

please take into consideration safety of all crew and staff. Concurrently, as stated above, the EC-ITA coordinator should be notified immediately.

k) Protected Species Handling

In general, following a "common sense" approach to handling protected species will present the best chance of minimizing injury to the animal and of decreasing risks to scientists, officers and crew. There are inherent safety concerns associated with handling/disentangling protected species, so using good judgment and ensuring human safety is paramount. SWFSC researchers should refer to PSIT-004.02 (**Appendix L**), SWFSC Marine Mammal Handling Guidelines, and the Pacific Islands Region's Identification, Handling and Release of Protected Species (PSIT-005.01, **Appendix L**), and SWFSC's marine mammal and sea turtle sampling protocol (PSIT-002.01, **Appendix L**) for more specific guidance on protected species handling and sampling (e.g., species identification, safe removal of fishing gear, etc.).

For all marine mammal and sea turtle incidental interactions, SWFSC researchers will record interaction information using the Protected Species Incidental Take Form and the Marine Mammal and Sea Turtle Biological Sampling form. For any incidental takes of protected fish species (salmon and eulachon), SWFSC researchers will fill out the Protected Fish Specimen Data form.

l) Protected Species Sampling and Data Collection

SWFSC scientists are authorized under MMPA regulation 50 CFR 216.22 and encouraged to collect samples from authorized protected species (see **Appendix L**) incidentally captured or killed during fisheries research activities. For sampling, follow guidelines in PSIT-002.02, SWFSCs Detailed Sampling Protocol for Marine Mammal and Sea Turtle Incidental Takes (**Appendix L**) and fill out the Marine Mammal and Sea Turtle Biological Sampling form.

D. Dive Plan

All dives are to be conducted in accordance with the requirements and regulations of the NOAA Diving Program (http://www.ndc.noaa.gov/dr.html) and require the approval of the ship's CO.

A dive is requested for clearing the CUFES intake of attached mussels prior to departure and the transducer faces (the ME70, in particular; the EK60/80 transducer faces may be cleaned with the centerboard in the "maintenance" position) of any marine biofouling prior to calibration.

E. Applicable Restrictions

In the event of poor weather conditions, we will work with the ship's officers on developing the best strategy the safe completion of all sampling. We have replacement gear for most operations; equipment failure should not impact our project.

Mitigation Measures for Protected Species during Scientific Operations

Cetacean visual and acoustic survey operations, including approach and sampling of cetaceans and sea turtles during this project are permitted under SWFSC's NMFS Take Permit 19091 and do not require "move on" mitigation during daytime operations.

III. Equipment

A. Equipment and Capabilities provided by the ship (itemized)

We request the following systems and their associated support services, sufficient consumables, backup units, and on-site spares. **All measurement instruments are assumed to have current calibrations and we request that all pertinent calibration information be included in the data package.**

Starboard hydro winch with 0.375" cable for standard Bongo and Pairovet tows

Starboard hydro winch with 0.375" cable for standard CTD casts

Starboard A-frame w/blocks to accommodate 0.375" cables

Supplies necessary for at least two re-terminations of the A-frame conducting cable

Port and starboard trawl winches with 1.0" diameter mechanical cable

Stern gantries with blocks to accommodate 1.0" cable

Access to the trawl ramp

Winch monitoring system

Knudsen 12 kHz depth recorder or comparable (EK60/80)

Acoustic Doppler Current Profiler

EK60 general-purpose transceivers (GPTs) with transducers (ES18-11, ES38B, ES70-7C, ES120-7C, ES200-7C, ES333-7C).

Calibration apparatus for EK60 echosounders, including motorized downriggers, control box, and standard spheres.

ME70 and MS70 multibeam echosounder systems.

SX90 omnidirectional echosounder system. The lift for the sonar shall be lubricated if not done so in the previous year.

Trimble/Applanix POS-MV position and motion measurement system.

Differential-corrected GPS and/or GNSS positioning system.

Gyro.

NTP time server and client software that automatically synchronizes all echosounder and scientific computers at approximately 1-hour intervals.

A recent version of navigation planning software installed in scientific spaces (e.g., Chemistry Lab, Acoustics Lab) with planned transects and sampling stations (Rose Point, OpenCPN, etc.).

Very Small Aperture Terminal (VSAT) high-bandwidth satellite communication system

Seabird SBE911+ CTD with calibrated temperature, conductivity, oxygen and fluorometer sensors, including rosette with Niskin bottles (10 L, 12 each).

Thermosalinograph

Pump, collector and concentrator unit for CUFES water sampling.

(1) 75 lb. weight for bongo tows.

(1) 100 lb. weight for Pairovet tows.

Scientific Computing System (SCS).

Calibrated, motion-compensated balances for fish baskets, and calibration weights

Scientific (-20 °C) freezer (large freezer in wet lab is necessary in case of marine mammal bycatch – it cannot be used for human food)

Ultra-low (-80 °C) scientific freezer.

Refrigerator space for samples (cannot be used for human food)

Up to three (3) two-way radios for communication from the electronics lab to the winch operator

Deck hose with fresh water to rinse equipment

Iridium phone

Network folder for science access

CAT-5 (or better) cabling from CPUs in acoustic lab to the flying bridge consoles

Power, ship's GPS, and ship's SCS connections to CPUs running the flying bridge consoles (please note that it is very important that all science computers be connected to the same ship's GPS)

Canopy on flying bridge

Copy machine

Network access to a printer

Internet access, with notification if privileges are removed

Space on aft deck for two (2) Sonobuoy crates, and up to one (1) fish box

Space on bow for two (2) fish boxes

Space on flying bridge for up to six (6) fish boxes

Two (2) ship's GPS connections to the dry lab for acoustics computers (please note that it is very important that all science computers be connected to the same ship's GPS).

Biopsy platform at bow and attachment straps (harness gear for biopsiers and photographers)

Grappling hook and line for DASBR retrieval

Spotlight to find DASBRs at night

Sonobuoy antenna and coax cable to the acoustic lab

B.   Equipment and Capabilities provided by the SWFSC (itemized)
      Fisheries Resources Division
      EK80 wide-band transceivers (WBTs) (18-, 38-, 70-, 120-, 200-, and 333-kHz)

(8) 30-cc and 50-cc syringes.

(5) Canulas

(10) Pint, (8) quart, (2) gallon, (4) 4 oz., and (9) 8 oz. jar cases (70 lbs.)

(5) Cases of scintillation vials (50 lbs.)Inside and outside labels

CalCOFI net tow data sheets

(2) 71-cm CalCOFI Bongo frames (40 lbs.)

(6) 71-cm CalCOFI 505 μm mesh nets (10 lbs.)

(4) CalCOFI 150 μm Pairovet nets and codends (5 lbs.)

(2) CalCOFI Pairovet frames (10 lbs.)

(12) 333 μm mesh codends (2 lbs.)

(6) Digital flowmeters (10 lbs.)

(1) 75-lb. Bongo weight

(1) 100-lb. hydro weight

(2) Standard CalCOFI tool boxes (50 lbs.)

(2) Bucket thermometers and holders (SIO)

(2) Handheld inclinometer for Pairovet and Bongo tows

(20) Weather observation sheets

(2) Dissecting microscopes (50 lbs. w/case)

(2) NETS Nordic 264 midwater trawl (6000 lbs.)

(2) NETS 3.0 m X Lite trawl doors (2400 lbs.)

(2) Trawl rigging (1000 lbs.)

(4) Fish measuring boards (20 lbs.)

(4) Motion compensated scales (100 lbs.)

 (1) Impedance-measuring transducer-multiplexer system (Z-MUX) (20 lbs.)

(1) EK60/EK80 echosounder multiplexer (EK-MUX) (20 lbs.)

(2) Computer to run the EK60/80 Adaptive Logging (EAL) software (10 lbs.)

(1) Steinberg UR44 USB audio interface and (3) audio cables

(1) Laptop computer with PAMGuard passive acoustic monitoring software installed

(1) Underway CTD – (UCTD, 2 probes, 1 winch (80 lbs.)

(1) Lander package including autonomous wideband echosounder (Simrad WBAT, yellow) with 55-95 kHz transducer (Simrad ES70-18CD, red); a passive acoustic logger (Multielectronique Aural M2, white); a 300 kHz ADCP (Teledyne RDI Workhorse Monitor); a UHMW backplane with four floats; two acoustic releases (yellow and black); and a ~150 kg sacrificial ballast (steel chain links) (Loaded in SF following Leg II)

 (14) Shipping containers (fish bins) (250 lbs.)

Marine Mammal and Turtle Division
(5) 7 x 5 handheld binoculars

(4) 25 x 150 "big-eye" binoculars and stands

(1) 20 x 60 handheld gyro-stabilized binoculars

(1) Video camera

(4) Digital cameras, lenses, and accessories

(8) Handheld radios

(1) Console radio and antenna for flying bridge

(3) Laptop computers for Cruise Leader, photography team, biopsy, and backup unit

(3) Desktop computers mounted in acoustic room with CAT5 (or better) KVM extension units at CPUs and remote console units on flying bridge

(1) Portable GPS unit

Crossbows, biopsy darts and tips, sample vials, and long-handled dip nets

(1) Laptop computer for biopsy data entry and two printers

Permits for specimen collection

(2) Pallets of Sonobuoys (48 in x 40 in x 60 in, 1200 lb when full)

(9) Fish boxes (acoustic equipment, survey gear, biopsy gear, DASBRs retrieved)

Oceanographic data logs and books

Computer data storage media for data (flash drives and external hard drives)

DASBRs (will be retrieved during the survey)

Soundtrap ST4300 recorder and two HTI-96-min hydrophones

Towed passive acoustic array; self-contained device (includes hydrophones and data recorder in a 4" diameter by 1-m long tubular housing) (will be line-attached to ship; no cable or winch required)

12v Line puller to retrieve DASBRs

(1) Fish boxes to be secured on bow by deck department (under the steps)

Iridium (satellite) phone

IV.   Hazardous Materials
A.   Policy and Compliance

The CL/CS is responsible for complying with FEC 07 Hazardous Materials and Hazardous Waste Management Requirements for Visiting Scientific Parties (or the OMAO procedure that supersedes it). By Federal regulations and NOAA Marine and Aviation Operations policy, the ship may not sail without a complete inventory of all hazardous materials by name and the anticipated quantity brought aboard, MSDS and appropriate neutralizing agents, buffers, or absorbents in amounts adequate to address spills of a size equal to the amount of chemical brought aboard, and a chemical hygiene plan. Documentation regarding those requirements will be provided by the Chief of Operations, Marine Operations Center, upon request.

Per OMAO procedures, the scientific party will include with their project instructions and provide to the CO of the respective ship 30 days before departure:

- List of chemicals by name with anticipated quantity
- List of spill response materials, including neutralizing agents, buffers, and absorbents
- Chemical safety and spill response procedures, such as excerpts of the program's Chemical Hygiene Plan or SOPs relevant for shipboard laboratories

- For bulk quantities of chemicals in excess of 50 gallons total or in containers larger than 10 gallons each, notify ship's Operations Officer regarding quantity, packaging, and chemical to verify safe storage is available as soon as chemical quantities are known.

Upon embarkation and prior to loading hazardous materials aboard the vessel, the scientific party will provide to the CO or their designee:

- An inventory list showing actual amount of hazardous material brought aboard
- An MSDS for each material
- Confirmation that neutralizing agents and spill equipment were brought aboard sufficient to contain and clean up all of the hazardous material brought aboard by the program
- Confirmation that chemical safety and spill response procedures were brought aboard

Upon departure from the ship, scientific parties will provide the CO or their designee an inventory showing that all chemicals were removed from the vessel. The CO's designee will maintain a log to track scientific party hazardous materials. MSDS will be made available to the ship's complement, in compliance with Hazard Communication Laws.

Scientific parties are expected to manage and respond to spills of scientific hazardous materials. Overboard discharge of hazardous materials is not permitted aboard NOAA ships.

B.   Inventory

Common Name of Material	Qty.	Notes	Trained Individuals	Spill control	Group
Ethyl alcohol (95%)	15 gallons(in 5-gallon cans)	UN1170, Waste contained and disposed of by SWFSC at end of project, Stored in hazardous material room and cabinet under fume hood	Dave Griffith, Sue Manion	F	FRD
Ethyl alcohol (95%)	20 L (in 20 ml vials)	No waste. Stored in Chem Lab	Dave Griffith, Sue Manion	F	FRD
Buffered formalin (10%)	20 gallons in 4 oz. and 8 oz. jars.	Stored in wet lab, no waste	Dave Griffith, Sue Manion	F	FRD
Formaldehyde solution (37%)	5 gallons	No waste, Stored in wet lab fume hood	Dave Griffith, Sue Manion	F	FRD
Tris buffer	500ml	Stored in Chem Lab	Dave Griffith, Sue Manion	F	FRD
Sodium borate powder	500gr	Stored in Chem Lab	Dave Griffith, Sue Manion	D	FRD
Cetylcide	1 Liter	Stored in Wet Lab HazMat cabinet	Juan Carlos Salinas	C	MMTD
Isopropyl (70%)	1 Liter	Stored in Wet Lab HazMat cabinet	Juan Carlos Salinas	F	MMTD
Bleach	1 Gallon	Stored in Wet Lab HazMat cabinet	Juan Carlos Salinas	C	MMTD
Ethanol (70%)	1 Liter	Stored in Wet Lab HazMat cabinet	Juan Carlos Salinas	F	MMTD

C.   Chemical safety and spill response procedures

C: Corrosive

- Wear appropriate protective equipment and clothing during cleanup.
- Ventilate closed spaces before entering them.
- Never mix chlorine bleach with any other household cleaners.
- Stop the flow of material, if this is without risk. Dike the spilled material, where this is possible.
- Large Spills: Dike far ahead of spill for later disposal. Use a non-combustible material like vermiculite, sand, or earth to soak up the product and place into a container for later disposal.
- Small Spills: Wipe up with absorbent material (e.g. cloth, fleece). Clean surface thoroughly to remove residual contamination.
- Never return spills in original containers for re-use.
- Neutralize spill area and washings with water. Collect in a non-combustible container for prompt disposal.

F: Formalin/Formaldehyde/Ethanol/Acetone

- Ventilate area of leak or spill. Remove all sources of ignition.
- Wear appropriate personal protective equipment.
- Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible.
- Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e.g., vermiculite, dry sand, earth), and place in a chemical waste container.
- Do not use combustible materials, such as sawdust.

D: Powdered and granular chemicals

- Wear appropriate protective equipment and clothing during clean-up. Keep upwind. Keep out of low areas.
- Sweep up dry chemical and place in a doubled ziplock bag.
- If contact with water occurs, use proper neutralizing agent prior to cleanup.
- Store in sealed container to be returned and disposed of by SWFSC.

Inventory of Spill Kit Supplies

Product Name	Amount	Chemicals it is useful against	Amount it can clean up
Chemical Spill pads	100	Formaldehyde, Alcohols	29 gallons
Formaldehyde Eater	5 gal	Formaldehyde	10 gallons
N/A	Absorbent material and vermiculite	Cetylcide, Alcohol, Bleach	2 gallons

D. Radioactive Materials

No Radioactive Isotopes are planned for this project.

V. Additional Projects

A. Supplementary ("Piggyback") Projects

Joint survey using Saildrones

Five Saildrones (http://saildrone.com) will be independently deployed and operated during the CCES. Two Saildrones, departing from Neah Bay, WA, will approximately replicate the ship's transects from the north end of west Vancouver Island to San Francisco, CA. Two Saildrones, departing from San Francisco, will

approximately replicate the ship's transects from San Francisco to the US-Mexican border. The operations of these Saildrones will be coordinated by Lawrence Hufnagle (Lawrence.C.Hufnagle@noaa.gov) and Dezhang Chu (Dezhang.Chu@noaa.gov) from the NWFSC. The fifth Saildrones, departing from San Francisco, will conduct nearshore transects between Cape Mendocino and Point Conception, then repeat a transect off Point Conception along CalCOFI Line 80 (**Appendix F and G**). CDR John Crofts (John.Crofts@noaa.gov) will liaise with Saildrone, Inc. regarding the fifth Saildrones. All Saildrone deployments and operations, e.g., navigation and data recording, will be conducted by the manufacturer. The analysis of Saildrone data will be performed by the NWFSC and SWFSC.

Nearshore-sampling Lander

Between Legs III and IV in San Francisco, during August 9-13, 2018, an instrumented lander (see **Appendix O**) will be loaded aboard the ship. The lander will be deployed in ~100-m depth off Point Conception (34.4388, -120.5472), on a nearshore extension of CalCOFI Line 80, as the ship transits north to resume acoustic-trawl sampling. The codes for the acoustic releases will be recorded, to facilitate retrieval of the lander during the following spring CalCOFI survey. The lander deployment will be from the ship's stern, using the A-frame and a snap hook. When the ship is located over the lander position, the instrument package will be positioned on the water surface and the snap hook will be released. The position and time of the release will be recorded in the SCS.

Opportunistic sea turtle observations

During normal cetacean and seabird visual surveys, the observers will also watch for sea turtles along the trackline. If a turtle is sighted, the observers will record the GPS location and collect photographs for species identification.

Opportunistic self-contained passive acoustic logger

During offshore transect lines (for marine mammal survey), a passive acoustic device (4" diameter x 1-m long tube) will be towed by line from the starboard stern of the vessel. The device includes hydrophones and on-board data recorder. No acoustic cable or winch is required.

Disentangle sea turtles and/or seabirds

Efforts to disentangle sea turtles or seabirds may be conducted on an opportunistic basis at the discretion of the Cruise Leader. Permits to disentangle sea turtles and/or seabirds will be present on the vessel. All disentangled sea turtles or seabirds will be released back to the ocean.

B.   NOAA Fleet Ancillary Projects

Ancillary tasks will be accomplished in accordance with the NOAA Fleet Standing Ancillary instructions as long as they do not interfere with primary mission objectives.

VI.   Disposition of Data and Reports

Disposition of data gathered aboard NOAA ships will conform to NAO 216-101 *Ocean Data Acquisitions* and NAO 212-15 *Management of Environmental Data and Information.* To guide the implementation of these NAOs, NOAA's Environmental Data Management Committee (EDMC) provides the *NOAA Data Documentation Procedural Directive* (data documentation) and *NOAA Data Management Planning Procedural Directive* (preparation of Data Management Plans). OMAO is developing procedures and allocating resources to manage OMAO data and Programs are encouraged to do the same for their project data.

The CL/CS will receive all original data related to the project from the ST. The CL/CS will, in turn, furnish the CO with a complete inventory listing of all data gathered by the scientific party, detailing types of operations and quantities of data prior to departing the ship. All data gathered by the vessel's personnel that are desired by the CL/CS will be released to them, including supplementary data specimens and photos gathered by the scientific crew.

The bridge will keep track of all scientific station operations (e.g., each small boat launch and retrieval, CTD/UCTD cast, and DASBR retrieval, Sonobuoy launch). Each of these station operations will be assigned a unique station number using a sequential number sequence starting with Station #1 for the first scientific station operation. Each station number will have a start and end position, date, time, and depth over water. The Bridge will use the SCS system to event mark the start and end time of each station operation. For small boat sampling operations, the same station number will be used for both launch and recovery. The ST and scientists will collect the more detailed primary data associated with each of the station operations.

Data Disposition: The CS shall be considered the representative of the NMFS SWFSC Science Director for purposes of data disposition.

VII.   Meetings, Vessel Familiarization, and Project Evaluations

A.   Pre-Project Meeting

The CL/CS and CO will convene a meeting of pertinent members of the scientific party and ship's crew to discuss required equipment, planned operations, concerns, and establish mitigation strategies for all concerns. This meeting shall be conducted before the beginning of the project with sufficient time to allow for preparation of the ship and project personnel. The ship's Operations Officer usually is delegated to assist the CL/CS in arranging this meeting.

B.   Vessel Familiarization Meeting

The CO is responsible for ensuring scientific personnel are familiarized with applicable sections of the standing orders and vessel protocols, e.g., meals, watches, etiquette, drills, etc. A vessel familiarization meeting shall be conducted in the first 24 hours of the project's start and is normally presented by the ship's Operations Officer.

C.   Post-Project Meeting

The CO is responsible for convening a meeting no earlier than 24 hours before or 7 days after the completion of a project to discuss the overall successes and shortcomings of the project. Concerns regarding safety, efficiency, and suggestions for future improvements shall be discussed and mitigations for future projects will be documented for future use. This meeting shall be attended by the ship's officers, applicable crew, the CL/CS, and members of the scientific party and is normally arranged by the Operations Officer and CL/CS.

D.   Project Evaluation Report

Within seven days of the completion of the project, a Customer Satisfaction Survey is to be completed by the CS. The form is available at https://sites.google.com/a/noaa.gov/omao-intranet-dev/operations/marine/customer-satisfaction-survey and provides a "Submit" button at the end of the form. It is also located at https://docs.google.com/a/noaa.gov/forms/d/1a5hCCkgIwaSII4DmrHPudAehQ9HqhRqY3J_FXqbJp9g/viewform. Submitted form data is deposited into a spreadsheet used by OMAO management to analyze the information. Though the complete form is not shared with the ships, specific concerns and praises are followed up on while not divulging the identity of the evaluator.

VIII.   Miscellaneous

A.   Meals and Berthing

The ship will provide meals for the scientists listed above. Meals will be served three times daily beginning one hour before scheduled departure, extending throughout the project, and ending two hours after the termination of the project. Since the watch schedule is split between day and night, the night watch may often miss daytime meals and will require adequate food and beverages (for example, a variety of sandwich items, cheeses, fruit, milk, juices) during what are not typically meal hours. Special dietary requirements for scientific participants will be made available to the ship's command at least seven days prior to the survey.

All scientific berths should be cleaned prior to occupation at the start of the survey.

Berthing requirements, including number and gender of the scientific party, will be provided to the ship by the CL/CS. The CL/CS and CO will work together on a detailed berthing plan to ensure that scientist are first berthed with other scientists before sharing with crew taking into consideration the current make-up of the ship's complement. The CL/CS is responsible for ensuring the scientific berthing spaces are left in the condition in which they were received; for stripping bedding and linen return; and for the return of any room keys, which were issued. The CL/CS is also responsible for the cleanliness of the laboratory spaces and the storage areas utilized by the scientific party, both during the project and at its conclusion prior to departing the ship. The ship will ensure that the scientific berthing spaces are received cleaned and habitable.

All NOAA scientists will have proper travel orders when assigned to any NOAA ship. The CL/CS will ensure that all non-NOAA or non-Federal scientists aboard also have proper orders. It is the responsibility of the CL/CS to ensure that the entire scientific party has a mechanism in place to provide lodging and food and to be reimbursed for these costs in the event that the ship becomes uninhabitable and/or the galley is closed during any part of the scheduled project.

All persons boarding NOAA vessels give implied consent to comply with all safety and security policies and regulations, which are administered by the CO. All spaces and equipment on the vessel are subject to inspection or search at any time. All personnel must comply with OMAO's Drug and Alcohol Policy dated May 7, 1999, which forbids the possession and/or use of illegal drugs and alcohol aboard NOAA Vessels.

B.   Medical Forms and Emergency Contacts

The NOAA Health Services Questionnaire (NHSQ, Revised: 02 JAN 2012) must be completed in advance by each participating scientist. The NHSQ can be obtained from the CL/CS or the NOAA website http://www.corporateservices.noaa.gov/~noaaforms/eforms/nf57-10-01.pdf.

All NHSQs submitted after March 1, 2014, must be accompanied by NOAA Form (NF) 57-10-02 - Tuberculosis Screening Document in compliance with OMAO Policy 1008 (Tuberculosis Protection Program).

The completed form should be sent to the Regional Director of Health Services at Marine Operations Center. The participant can mail, fax, or scan the form into an email using the contact information below. The NHSQ should reach the Health Services Office no later than 4 weeks prior to the project to allow time for the participant to obtain and submit additional information that health services might require before clearance to sail can be granted. Please contact MOC Health Services with any questions regarding eligibility or completion of the NHSQ. Be sure to include proof of tuberculosis (TB) testing, sign, and date the form, and indicate the ship or ships on which the participant will be sailing. The participant will receive an email notice when medically cleared to sail if a legible email address is provided on the NHSQ.

The participant can mail, fax, or email the forms to the contact information below. Participants should take precautions to protect their Personally Identifiable Information (PII) and medical information and ensure all correspondence adheres to DOC guidance (http://ocio.os.doc.gov/ITPolicyandPrograms/IT_Privacy/PROD01_008240).

The only secure email process approved by NOAA is Accellion Secure File Transfer, which requires the sender to setup an account. Accellion's Web Users Guide is a valuable aid in using this service, however, to reduce cost the DOC contract does not provide for automatically issuing full functioning accounts. To receive access to a "Send Tab", after your Accellion account has been established send an email from the associated email account to accellionAlerts@doc.gov requesting access to the "Send Tab" function. They will notify you via email usually within 1 business day of your approval. The 'Send Tab" function will be accessible for 30 days.

Contact information:

Regional Director of Health Services
Marine Operations Center – Pacific
2002 SE Marine Science Dr.
Newport, OR 97365
Telephone 541-867-8822
Fax 541-867-8856
Email MOP.Health-Services@noaa.gov

Prior to departure, the CL/CS must provide an electronic listing of emergency contacts to the Executive Officer for all members of the scientific party, with the following information: contact name, address, relationship to member, and telephone number.

C.   Shipboard Safety

Hard hats are required when working with suspended loads. Work vests are required when working near open railings and during small boat launch and recovery operations. Hard hats and work vests will be provided by the ship when required.

Wearing open-toed footwear or shoes that do not completely enclose the foot (such as sandals or clogs) outside of private berthing areas is not permitted. At the discretion of the ship CO, safety shoes (i.e. steel or composite toe protection) may be required to participate in any work dealing with suspended loads, including CTD deployment and recovery. The ship does not provide safety-toed shoes/boots. The ship's Operations Officer should be consulted by the CL/CS to ensure members of the scientific party report aboard with the proper attire.

D.   Communications

A progress report on operations prepared by the CL/CS may be relayed to the program office. Sometimes it is necessary for the CL/CS to communicate with another vessel, aircraft, or shore facility. Through various means of communications, the ship can usually accommodate the CL/CS. Special radio voice communications requirements should be listed in the project instructions. The ship's primary means of communication with the Marine Operations Center is via e-mail and the Very Small Aperture Terminal (VSAT) link. Standard VSAT bandwidth at 128 kbs is shared by all vessels staff and the science team at no charge. Increased bandwidth in 30-d increments is available on the VSAT systems at increased cost to the scientific party. If increased bandwidth is being considered, program accounting is required it must be arranged at least 30 d in advance.

E.   IT Security

Any computer that will be connected to the ship's network must comply with the *NMAO Fleet IT Security Policy* 1.1 (November 4, 2005) prior to establishing a direct connection to the NOAA WAN. Requirements include, but are not limited to:

- Installation of the latest virus definition (.DAT) file on all systems and performance of a virus scan on each system.
- Installation of the latest critical operating system security patches.
- No external public Internet Service Provider (ISP) connections.

Completion of the above requirements prior to boarding the ship is required.

Non-NOAA personnel using the ship's computers or connecting their own computers to the ship's network must complete NOAA's IT Security Awareness Course within 3 days of embarking.

F.   Foreign National Guests Access to OMAO Facilities and Platforms

All foreign national access to the vessel shall be in accordance with NAO 207-12 and RADM De Bow's March 16, 2006, memo (http://deemedexports.noaa.gov). National Marine Fisheries Service personnel will use the Foreign National Registration System (FNRS) to submit requests for access to NOAA facilities and

ships. The Departmental Sponsor/NOAA (DSN) is responsible for obtaining clearances and export licenses and for providing escorts required by the NAO. DSNs should consult with their designated NMFS Deemed Exports point of contact to assist with the process.

Full compliance with NAO 207-12 is required.

Responsibilities of the CS:

a)   Provide the CO with the e-mail generated by the FNRS granting approval for the foreign national guest's visit. This e-mail will identify the guest's DSN and will serve as evidence that the requirements of NAO 207-12 have been complied with.

b)   Escorts – The CS is responsible for providing escorts to comply with NAO 207-12 Section 5.10, or as required by the vessel's DOC/OSY Regional Security Officer.

c)   Ensure all non-foreign national members of the scientific party receive the briefing on Espionage Indicators (NAO 207-12, Appendix A therin) at least annually or as required by the servicing Regional Security Officer.

d)   Export Control - Ensure that approved controls are in place for any technologies that are subject to Export Administration Regulations (EAR).

The CO and the CS will work together to implement any access controls necessary to ensure no unlicensed export occurs of any controlled technology onboard regardless of ownership.

Responsibilities of the CO:

a)   Ensure only those foreign nationals with DOC/OSY clearance are granted access.

b)   Deny access to OMAO platforms and facilities by foreign nationals from countries controlled for anti-terrorism (AT) reasons and individuals from Cuba or Iran without written NMAO approval and compliance with export and sanction regulations.

c)   Ensure foreign national access is permitted only if unlicensed deemed export is not likely to occur.

d)   Ensure receipt from the CS or the DSN of the FNRS e-mail granting approval for the foreign national guest's visit.

e)   Ensure Foreign Port Officials, e.g., Pilots, immigration officials, receive escorted access in accordance with maritime custom to facilitate the vessel's visit to foreign ports.

f)   Export Control - 8 weeks in advance of the project, provide the CS with a current inventory of OMAO controlled technology onboard the vessel and a copy of the vessel Technology Access Control Plan (TACP). Also, notify the CS of any OMAO-sponsored foreign nationals that will be onboard while program equipment is aboard so that the CS can take steps to prevent the unlicensed export of Program controlled technology. The CO and the CS will work together to implement any access controls necessary to ensure no unlicensed export occurs of any controlled technology onboard regardless of ownership.

g)   Ensure all OMAO personnel onboard receive the briefing on Espionage Indicators (NAO 207-12, Appendix A therein) at least annually or as required by the servicing Regional Security Officer.

Responsibilities of the Foreign National Sponsor:

a)	Export Control - The foreign national's sponsor is responsible for obtaining any required export licenses and complying with any conditions of those licenses prior to the foreign national being provided access to the controlled technology onboard regardless of the technology's ownership.

b)	The DSN of the foreign national shall assign an onboard Program individual, who will be responsible for the foreign national while on board. The identified individual must be a U.S. citizen, NOAA (or DOC) employee. According to DOC/OSY, this requirement cannot be altered.

c)	Ensure completion and submission of NAO 207-12 Appendix C (Certification of Conditions and Responsibilities for a Foreign National

IX. Appendices

A. Survey Map

Planned compulsory (solid lines, waypoints in **Appendix C**) and adaptive (long-dashed lines, waypoints in **Appendix D**) acoustic transects; extended marine mammal transects (**Appendix E**); Saildrone transects (orange lines, **Appendix G**), UCTD stations (white points, waypoints in **Appendix H**) and DASBR stations (yellow diamonds, **Appendix I**) for RL-18-07. Compulsory transects are generally spaced 20-nmi apart, with adaptive transects between, every 10 nmi, except off Washington and Oregon where compulsory lines have 10-nmi spacing. Transects begin at a water depth of ca. 30 m and extend offshore at least 35 nmi or to the 1000 fathom contour (light gray line). The transit (dotted line) from San Francisco to the northern end of Vancouver following the route in **Appendix J**.
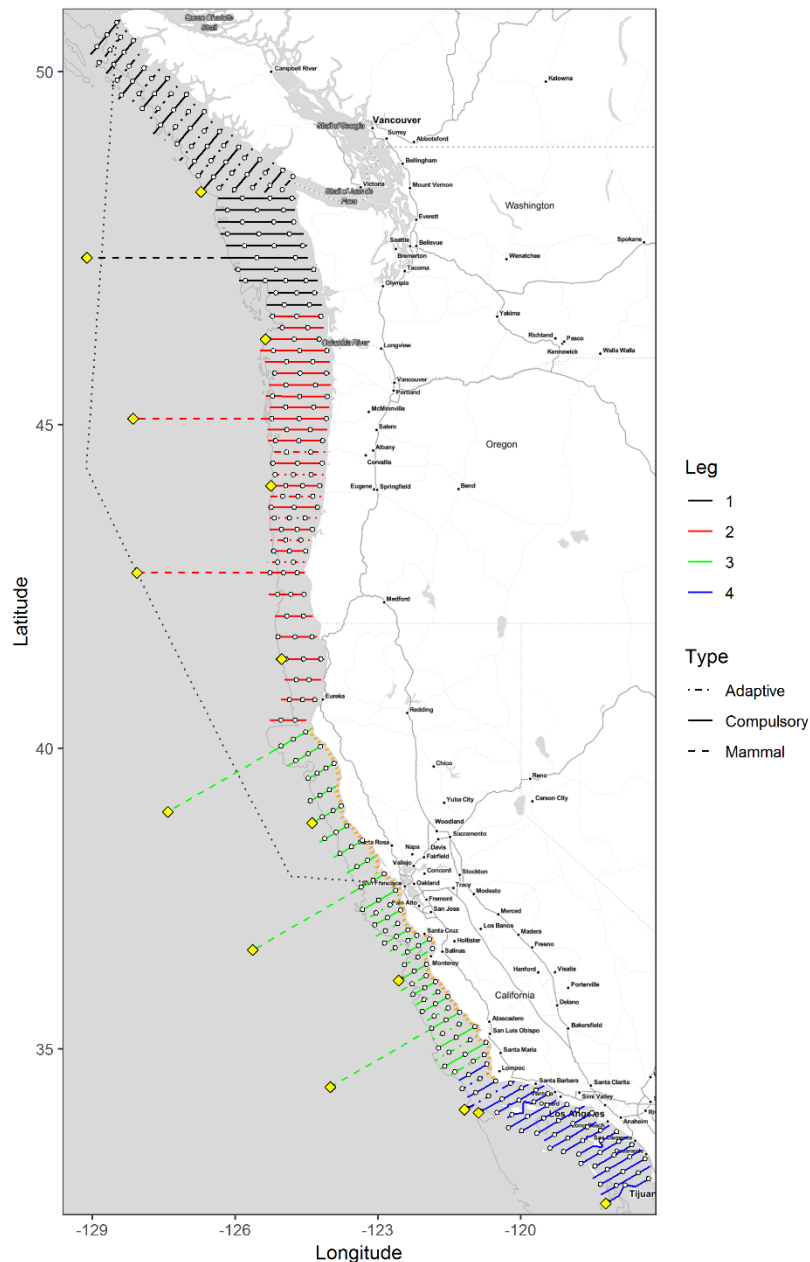
B.   Survey Design and Adaptive Sampling Protocol
         The proposed survey design attempts to make optimal use of the available survey time by allocating *a priori* higher effort in regions of highest interest: Washington and Oregon, San Francisco and Monterey regions (see **Appendix A**). In these regions transects are placed every 10 nmi for maximum resolution and precision. Outside these regions, transects are placed every 20 nmi to achieve a balance between precision and time savings. Together, they form the "compulsory survey pattern".

         Within the areas of the compulsory pattern on which transects are spaced by 20 nmi, additional transects might be added upon the observation of CPS. These transects are called adaptive transects because they will result in adapting the survey design *on-the-fly*. Adaptive transects might be added according to the following protocol:

    1.   If CPS are observed during a compulsory transect, an adaptive transect will be added 10 nmi to the north. The ship will then transit to the transect 20 nmi south to resume sampling on the next adaptive transect, followed by a compulsory transect and one last adaptive transect. This scheme guarantees that when adaptive sampling is initiated, there is a minimum of 3 adaptive transect added to the compulsory pattern to comprise a stratum.
    2.   If CPS eggs or adults are encountered on the last compulsory transect of the adaptive event, continue adding adaptive transects to the compulsory pattern. Revert to the compulsory sampling pattern once CPS are absent from a compulsory transect.
    3.   Resume adaptive sampling once CPS eggs or adults are found.

C.   Compulsory Acoustic Sampling Waypoints

Waypoints for the compulsory acoustic transects mapped in **Appendix A**. Transects are numbered from south to north, but will be sampled from north to south. Transects begin at a water depth of ca. 30 m and extend offshore at least 35 nmi or to the 1000 fathom contour.

Transect	Waypoint	Latitude	Longitude	Type
1	1.1	32.757931	-117.285110	Compulsory
1	1.102	32.606610	-117.596024	Compulsory
1	1.103	32.631663	-117.829795	Compulsory
1	1.104	32.444922	-117.930869	Compulsory
1	1.105	32.303354	-118.221005	Compulsory
2	2.1	32.961511	-117.287107	Compulsory
2	2.2	32.461289	-118.316413	Compulsory
3	3.1	33.117342	-117.344333	Compulsory
3	3.2	32.617943	-118.376102	Compulsory
4	4.1	33.245938	-117.474144	Compulsory
4	4.101	32.823830	-118.345408	Compulsory
4	4.102	32.819136	-118.344208	Compulsory
4	4.103	32.814121	-118.350925	Compulsory
4	4.104	32.812690	-118.366491	Compulsory
4	4.2	32.747926	-118.499680	Compulsory
5	5.1	33.363135	-117.609926	Compulsory
5	5.2	32.935800	-118.494136	Compulsory
6	6.1	33.488977	-117.747652	Compulsory
6	6.2	32.989119	-118.783258	Compulsory
7	7.1	33.586933	-117.944648	Compulsory
7	7.101	33.393326	-118.344827	Compulsory
7	7.102	33.329721	-118.290659	Compulsory
7	7.103	33.306540	-118.288365	Compulsory
7	7.104	33.290159	-118.324994	Compulsory
7	7.105	33.311122	-118.382177	Compulsory
7	7.106	33.309868	-118.422504	Compulsory
7	7.107	33.317433	-118.490453	Compulsory
7	7.2	33.151260	-118.835011	Compulsory
8	8.1	33.678706	-118.143570	Compulsory
8	8.101	33.487863	-118.540503	Compulsory
8	8.102	33.488507	-118.601295	Compulsory
8	8.103	33.470479	-118.624018	Compulsory
8	8.104	33.448073	-118.620955	Compulsory
8	8.2	33.190200	-119.154861	Compulsory
9	9.1	33.741049	-118.419978	Compulsory
9	9.2	33.253906	-119.432220	Compulsory
10	10.1	33.913516	-118.468280	Compulsory
10	10.2	33.413550	-119.509676	Compulsory

11	11.1	34.017292	-118.665829	Compulsory
11	11.2	33.516775	-119.707306	Compulsory
12	12.1	34.054230	-118.998839	Compulsory
12	12.2	33.553738	-120.041102	Compulsory
13	13.1	34.114535	-119.263594	Compulsory
13	13.2	33.614453	-120.307469	Compulsory
14	14.1	34.244818	-119.390049	Compulsory
14	14.101	34.065229	-119.765806	Compulsory
14	14.102	34.093135	-119.927319	Compulsory
14	14.103	34.055201	-119.958283	Compulsory
14	14.104	33.978849	-119.945053	Compulsory
14	14.105	33.893327	-119.955311	Compulsory
14	14.106	33.881724	-120.145767	Compulsory
14	14.2	33.815166	-120.284748	Compulsory
15	15.1	34.369935	-119.514599	Compulsory
15	15.101	34.047609	-120.189014	Compulsory
15	15.102	34.053801	-120.229226	Compulsory
15	15.103	34.038544	-120.255897	Compulsory
15	15.104	34.013259	-120.261516	Compulsory
15	15.2	33.876175	-120.547062	Compulsory
16	16.1	34.398003	-119.844959	Compulsory
16	16.2	33.897721	-120.891872	Compulsory
18	18.1	34.466051	-120.489990	Compulsory
18	18.2	34.163658	-121.123083	Compulsory
20	20.1	34.762540	-120.663922	Compulsory
20	20.2	34.460512	-121.299080	Compulsory
22	22.1	35.128642	-120.697125	Compulsory
22	22.2	34.656503	-121.695656	Compulsory
24	24.1	35.400694	-120.925872	Compulsory
24	24.2	35.009630	-121.756184	Compulsory
26	26.1	35.643163	-121.255241	Compulsory
26	26.2	35.345609	-121.887416	Compulsory
28	28.1	35.907562	-121.498304	Compulsory
28	28.2	35.612833	-122.126411	Compulsory
30	30.1	36.185322	-121.719197	Compulsory
30	30.2	35.893349	-122.344156	Compulsory
32	32.1	36.463924	-121.936488	Compulsory
32	32.2	36.171905	-122.564457	Compulsory
34	34.1	36.883263	-121.881521	Compulsory
34	34.2	36.591594	-122.511917	Compulsory
36	36.1	37.064391	-122.281900	Compulsory
36	36.2	36.772427	-122.913573	Compulsory
38	38.1	37.378880	-122.469813	Compulsory

38	38.2	37.081431	-123.117809	Compulsory
40	40.1	37.701285	-122.579814	Compulsory
40	40.2	37.330070	-123.391823	Compulsory
42	42.1	37.975384	-122.820713	Compulsory
42	42.2	37.683469	-123.460599	Compulsory
44	44.1	38.262803	-123.020291	Compulsory
44	44.2	37.970886	-123.662841	Compulsory
46	46.1	38.520500	-123.288000	Compulsory
46	46.2	38.228612	-123.933118	Compulsory
48	48.1	38.771666	-123.584303	Compulsory
48	48.2	38.480491	-124.231026	Compulsory
50	50.1	39.085206	-123.730961	Compulsory
50	50.2	38.793657	-124.380941	Compulsory
52	52.1	39.412553	-123.832208	Compulsory
52	52.2	39.120803	-124.485703	Compulsory
54	54.1	39.782179	-123.867967	Compulsory
54	54.2	39.490834	-124.524127	Compulsory
56	56.1	40.070235	-124.114106	Compulsory
56	56.2	39.716868	-124.911232	Compulsory
58	58.1	40.324513	-124.374712	Compulsory
58	58.2	39.975334	-125.167200	Compulsory
59	59.1	40.450675	-124.499839	Compulsory
59	59.2	40.450453	-125.266649	Compulsory
61	61.1	40.774860	-124.267434	Compulsory
61	61.2	40.774816	-125.037940	Compulsory
63	63.1	41.089336	-124.192159	Compulsory
63	63.2	41.089295	-124.966479	Compulsory
65	65.1	41.420246	-124.122526	Compulsory
65	65.2	41.419938	-125.020872	Compulsory
67	67.1	41.765263	-124.273393	Compulsory
67	67.2	41.764842	-125.112459	Compulsory
69	69.1	42.094185	-124.369283	Compulsory
69	69.2	42.094025	-125.163888	Compulsory
71	71.1	42.427484	-124.498174	Compulsory
71	71.2	42.427500	-125.288691	Compulsory
73	73.1	42.760922	-124.545210	Compulsory
73	73.2	42.760965	-125.340554	Compulsory
75	75.1	43.094170	-124.460000	Compulsory
75	75.2	43.094170	-125.259000	Compulsory
77	77.1	43.425777	-124.318279	Compulsory
77	77.2	43.425871	-125.271744	Compulsory
79	79.1	43.762113	-124.212676	Compulsory
79	79.2	43.761677	-125.311270	Compulsory

81	81.1	44.090209	-124.162541	Compulsory
81	81.2	44.090760	-125.250244	Compulsory
83	83.1	44.427500	-124.115000	Compulsory
83	83.2	44.426927	-125.273172	Compulsory
85	85.1	44.760121	-124.094859	Compulsory
85	85.2	44.759831	-125.306874	Compulsory
86	86.1	44.927166	-124.060106	Compulsory
86	86.2	44.927677	-125.319999	Compulsory
87	87.1	45.089578	-124.030625	Compulsory
87	87.2	45.089797	-125.307981	Compulsory
88	88.1	45.257741	-124.017084	Compulsory
88	88.2	45.257245	-125.276208	Compulsory
89	89.1	45.419625	-124.006197	Compulsory
89	89.2	45.420342	-125.354148	Compulsory
90	90.1	45.587952	-123.981286	Compulsory
90	90.2	45.587995	-125.284722	Compulsory
91	91.1	45.758069	-124.004704	Compulsory
91	91.2	45.758075	-125.218847	Compulsory
92	92.1	45.925711	-124.005665	Compulsory
92	92.2	45.925831	-125.376279	Compulsory
93	93.1	46.086853	-124.011655	Compulsory
93	93.2	46.087027	-125.480224	Compulsory
94	94.1	46.254299	-124.175380	Compulsory
94	94.2	46.254841	-125.364527	Compulsory
95	95.1	46.421495	-124.137029	Compulsory
95	95.2	46.421511	-125.109323	Compulsory
96	96.1	46.583691	-124.139192	Compulsory
96	96.2	46.583531	-125.282356	Compulsory
97	97.1	46.750333	-124.175920	Compulsory
97	97.2	46.750670	-125.338000	Compulsory
98	98.1	46.922993	-124.256264	Compulsory
98	98.2	46.923252	-125.302037	Compulsory
99	99.1	47.095329	-124.267517	Compulsory
99	99.2	47.095227	-125.916095	Compulsory
100	100.1	47.257610	-124.331267	Compulsory
100	100.2	47.258446	-126.014072	Compulsory
101	101.1	47.425683	-124.470533	Compulsory
101	101.2	47.424953	-126.154780	Compulsory
102	102.1	47.591494	-124.493527	Compulsory
102	102.2	47.592028	-126.194882	Compulsory
103	103.1	47.763292	-124.552919	Compulsory
103	103.2	47.763648	-126.304427	Compulsory
104	104.1	47.926094	-124.709633	Compulsory

104	104.2	47.926170	-126.360000	Compulsory
105	105.1	48.094026	-124.744406	Compulsory
105	105.2	48.093601	-126.406944	Compulsory
106	106.1	48.260833	-124.729000	Compulsory
106	106.2	48.260685	-126.355276	Compulsory
108	108.1	48.685585	-124.951879	Compulsory
108	108.2	48.344015	-125.384860	Compulsory
110	110.1	48.832449	-125.440105	Compulsory
110	110.2	48.343695	-126.060642	Compulsory
112	112.1	49.006020	-125.879865	Compulsory
112	112.2	48.349099	-126.713681	Compulsory
114	114.1	49.225031	-126.269415	Compulsory
114	114.2	48.671276	-126.976792	Compulsory
116	116.1	49.485047	-126.610656	Compulsory
116	116.2	48.986920	-127.250381	Compulsory
118	118.1	49.723331	-126.978800	Compulsory
118	118.2	49.155654	-127.711928	Compulsory
120	120.1	49.942709	-127.371290	Compulsory
120	120.2	49.485866	-127.963928	Compulsory
122	122.1	50.077583	-127.868524	Compulsory
122	122.2	49.630652	-128.450140	Compulsory
124	124.1	50.449639	-128.081812	Compulsory
124	124.2	49.975782	-128.702631	Compulsory
126	126.1	50.698335	-128.419893	Compulsory
126	126.2	50.233823	-129.031702	Compulsory

D.   Adaptive Acoustic Sampling Waypoints

Waypoints for the adaptive acoustic transects mapped in **Appendix A**. Transects are numbered from south to north, but will be sampled from north to south.

Transect	Waypoint	Latitude	Longitude	Type
17	17.1	34.449783	-120.135837	Adaptive
17	17.2	33.949662	-121.183105	Adaptive
19	19.1	34.583357	-120.667684	Adaptive
19	19.2	34.291097	-121.281257	Adaptive
21	21.1	34.922750	-120.719000	Adaptive
21	21.2	34.542616	-121.519064	Adaptive
23	23.1	35.233028	-120.897486	Adaptive
23	23.2	34.804697	-121.803339	Adaptive
25	25.1	35.521818	-121.094486	Adaptive
25	25.2	35.169750	-121.843000	Adaptive
27	27.1	35.778475	-121.353777	Adaptive
27	27.2	35.457273	-122.037563	Adaptive
29	29.1	36.046298	-121.596124	Adaptive
29	29.2	35.751487	-122.226432	Adaptive
31	31.1	36.284496	-121.901855	Adaptive
31	31.2	35.991805	-122.528591	Adaptive
33	33.1	36.717122	-121.828834	Adaptive
33	33.2	36.424995	-122.458413	Adaptive
35	35.1	36.950344	-122.136942	Adaptive
35	35.2	36.658568	-122.768327	Adaptive
37	37.1	37.195807	-122.432379	Adaptive
37	37.2	36.903875	-123.065235	Adaptive
39	39.1	37.527851	-122.543099	Adaptive
39	39.2	37.192555	-123.274691	Adaptive
74	74.1	42.927656	-124.531536	Adaptive
74	74.2	42.927904	-125.330373	Adaptive
76	76.1	43.260722	-124.430438	Adaptive
76	76.2	43.260751	-125.252422	Adaptive
78	78.1	43.598240	-124.274115	Adaptive
78	78.2	43.598541	-125.278241	Adaptive
80	80.1	43.927253	-124.187391	Adaptive
80	80.2	43.927182	-125.298442	Adaptive
82	82.1	44.256331	-124.140070	Adaptive
82	82.2	44.255752	-125.250122	Adaptive
84	84.1	44.594316	-124.108258	Adaptive
84	84.2	44.593871	-125.232993	Adaptive
107	107.1	48.590118	-124.745726	Adaptive
107	107.2	48.343789	-125.057658	Adaptive
109	109.1	48.759779	-125.185865	Adaptive

109	109.2	48.343872	-125.713131	Adaptive
111	111.1	48.951625	-125.635184	Adaptive
111	111.2	48.343839	-126.407556	Adaptive
113	113.1	49.139910	-126.047588	Adaptive
113	113.2	48.534930	-126.819156	Adaptive
115	115.1	49.321844	-126.480266	Adaptive
115	115.2	48.787394	-127.163457	Adaptive
117	117.1	49.561402	-126.844053	Adaptive
117	117.2	49.069036	-127.478570	Adaptive
119	119.1	49.804862	-127.211978	Adaptive
119	119.2	49.354255	-127.795077	Adaptive
121	121.1	50.035229	-127.584886	Adaptive
121	121.2	49.582654	-128.173783	Adaptive
123	123.1	50.239742	-128.006685	Adaptive
123	123.2	49.789131	-128.594983	Adaptive
125	125.1	50.554135	-128.277082	Adaptive
125	125.2	50.063818	-128.920582	Adaptive

E.	Marine Mammal Transect Extension Waypoints
Waypoints for the extended marine mammal transects mapped in **Appendix A**.

Transect	Waypoint	Latitude	Longitude	Type
26	26.1	35.345600	-121.887000	Mammal
26	26.2	34.347100	-123.999000	Mammal
42	42.1	37.683500	-123.461000	Mammal
42	42.2	36.684200	-125.635000	Mammal
58	58.1	39.975300	-125.167000	Mammal
58	58.2	38.975100	-127.411000	Mammal
73	73.1	42.761000	-125.341000	Mammal
73	73.2	42.761100	-128.065000	Mammal
87	87.1	45.089800	-125.308000	Mammal
87	87.2	45.090000	-128.141000	Mammal
101	101.1	47.425000	-126.155000	Mammal
101	101.2	47.424700	-129.111000	Mammal

F.   Saildrone Survey Map
       A map showing the location of Saildrone 5 transects spaced 5-nmi apart between Pt. Reyes and Point
       Conception (Transects 1-46; blue lines), nearshore and racetrack transects (Transects 13 and 33; red), and
       tollgate (CalCOFI Line 80; dashed black line; see waypoints in **Appendix G**). The inset shows the zig-zag
       sampling pattern (dashed black line) along a subset of planned transects (solid orange lines), the long-term
       sampling transects located 1 nmi north (dashed red line) and south (dashed green line) of Line 80, and the 1
       nmi-wide tacking corridor around each long-term transect (red- and green-shaded regions). The dashed box
       in the main panel indicates the approximate extent of the inset.
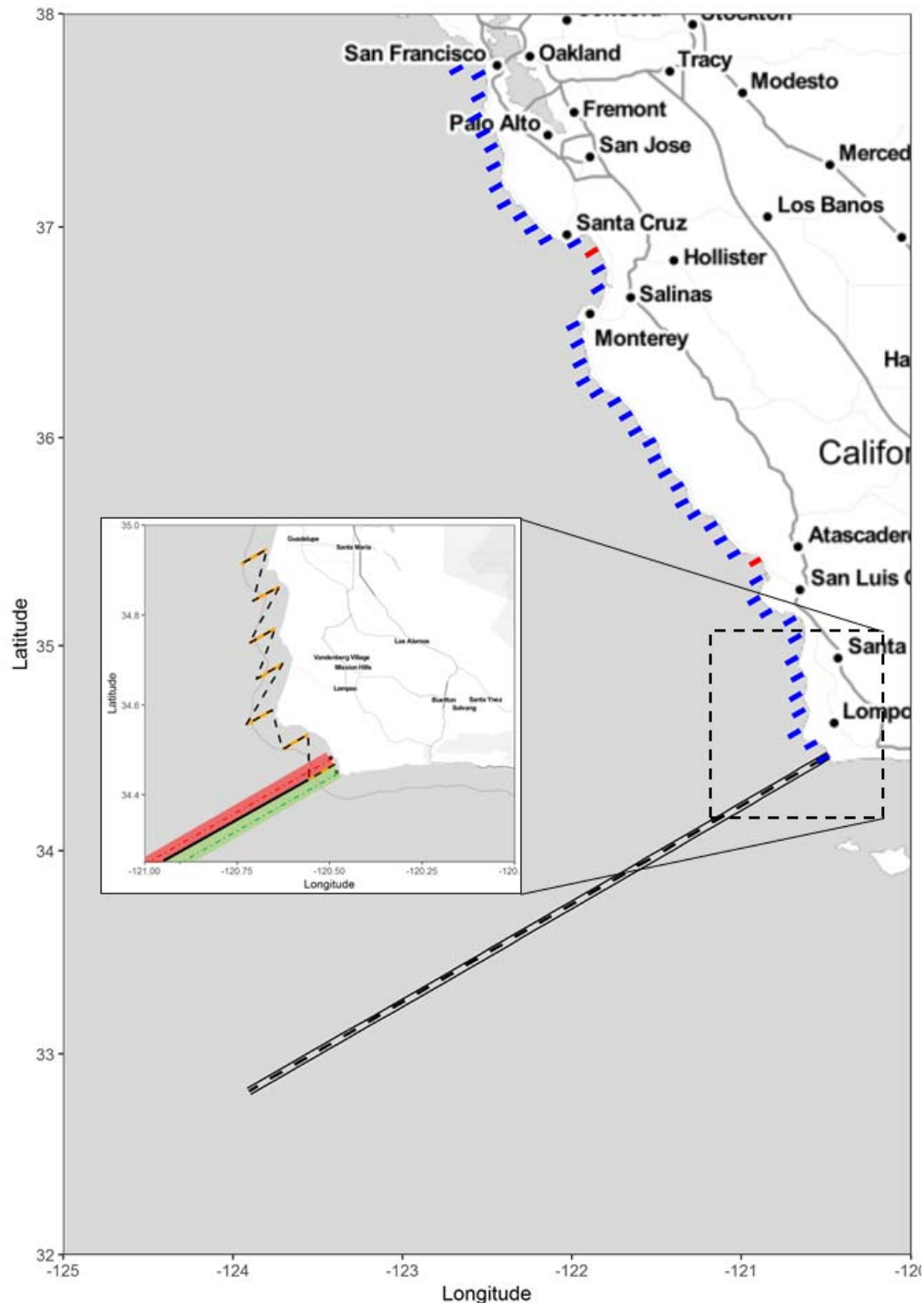
G. Saildrone Transect Waypoints

Waypoints for Saildrone transects mapped in **Appendix A** and **Appendix F**.

Transect	Waypoint	Latitude	Longitude	Type
CalCOFI 80	80.51	34.450000	-120.523911	Saildrone
CalCOFI 80	80.51	32.816667	-123.905965	Saildrone
1	1.1	34.468227	-120.485460	Saildrone
1	1.2	34.434894	-120.555395	Saildrone
2	2.1	34.534909	-120.557578	Saildrone
2	2.2	34.501595	-120.627254	Saildrone
3	3.1	34.589069	-120.655698	Saildrone
3	3.2	34.555833	-120.725612	Saildrone
4	4.1	34.691987	-120.626721	Saildrone
4	4.2	34.657961	-120.697821	Saildrone
5	5.1	34.770367	-120.647447	Saildrone
5	5.2	34.737016	-120.717682	Saildrone
6	6.1	34.863477	-120.635707	Saildrone
6	6.2	34.831621	-120.706911	Saildrone
7	7.1	34.946451	-120.669031	Saildrone
7	7.2	34.913199	-120.739163	Saildrone
8	8.1	35.051082	-120.650517	Saildrone
8	8.2	35.017435	-120.721889	Saildrone
9	9.1	35.136705	-120.680019	Saildrone
9	9.2	35.103460	-120.750550	Saildrone
10	10.1	35.173367	-120.821713	Saildrone
10	10.2	35.140822	-120.890951	Saildrone
11	11.1	35.235440	-120.892384	Saildrone
11	11.2	35.202119	-120.963052	Saildrone
12	12.1	35.299448	-120.949708	Saildrone
12	12.2	35.333067	-120.878582	Saildrone
13	13.1	35.418700	-120.887727	Saildrone
13	13.2	35.388510	-120.951827	Saildrone
14	14.1	35.457359	-121.010542	Saildrone
14	14.2	35.425154	-121.081814	Saildrone
15	15.1	35.525018	-121.087653	Saildrone
15	15.2	35.491664	-121.158608	Saildrone
16	16.1	35.592488	-121.145637	Saildrone
16	16.2	35.559910	-121.217942	Saildrone
17	17.1	35.647522	-121.245967	Saildrone
17	17.2	35.614115	-121.317031	Saildrone
18	18.1	35.702411	-121.316662	Saildrone
18	18.2	35.670542	-121.388644	Saildrone
19	19.1	35.782717	-121.344705	Saildrone
19	19.2	35.750184	-121.414129	Saildrone

20		20.1	35.846324	-121.417627	Saildrone
20		20.2	35.813391	-121.489717	Saildrone
21		21.1	35.917069	-121.478113	Saildrone
21		21.2	35.883828	-121.549055	Saildrone
22		22.1	35.994172	-121.506492	Saildrone
22		22.2	35.961610	-121.578248	Saildrone
23		23.1	36.048086	-121.592260	Saildrone
23		23.2	36.014760	-121.663683	Saildrone
24		24.1	36.120914	-121.646192	Saildrone
24		24.2	36.087271	-121.718963	Saildrone
25		25.1	36.187870	-121.713736	Saildrone
25		25.2	36.154454	-121.785291	Saildrone
26		26.1	36.230465	-121.820029	Saildrone
26		26.2	36.196432	-121.892087	Saildrone
27		27.1	36.285427	-121.899824	Saildrone
27		27.2	36.252087	-121.971574	Saildrone
28		28.1	36.372294	-121.918774	Saildrone
28		28.2	36.339354	-121.991544	Saildrone
29		29.1	36.465444	-121.933221	Saildrone
29		29.2	36.432086	-122.004933	Saildrone
30		30.1	36.549970	-121.959554	Saildrone
30		30.2	36.517274	-122.032009	Saildrone
31		31.1	36.724426	-121.813106	Saildrone
31		31.2	36.691018	-121.885149	Saildrone
32		32.1	36.816005	-121.808957	Saildrone
32		32.2	36.783328	-121.881913	Saildrone
33		33.1	36.898221	-121.849183	Saildrone
33		33.2	36.864872	-121.921431	Saildrone
34		34.1	36.940372	-121.951161	Saildrone
34		34.2	36.906981	-122.024832	Saildrone
35		35.1	36.957293	-122.121947	Saildrone
35		35.2	36.923801	-122.194397	Saildrone
36		36.1	37.006265	-122.205512	Saildrone
36		36.2	36.973330	-122.278107	Saildrone
37		37.1	37.068667	-122.272603	Saildrone
37		37.2	37.035634	-122.344430	Saildrone
38		38.1	37.124134	-122.365040	Saildrone
38		38.2	37.090709	-122.438966	Saildrone
39		39.1	37.204198	-122.414110	Saildrone
39		39.2	37.171001	-122.486214	Saildrone
40		40.1	37.303440	-122.427589	Saildrone
40		40.2	37.269308	-122.500384	Saildrone
41		41.1	37.391832	-122.441623	Saildrone

41	41.2	37.358591	-122.513948	Saildrone
42	42.1	37.459153	-122.488541	Saildrone
42	42.2	37.426321	-122.562660	Saildrone
43	43.1	37.532175	-122.533586	Saildrone
43	43.2	37.498843	-122.606357	Saildrone
44	44.1	37.629150	-122.517597	Saildrone
44	44.2	37.595767	-122.592535	Saildrone
45	45.1	37.730698	-122.515385	Saildrone
45	45.2	37.697387	-122.588378	Saildrone
46	46.1	37.756218	-122.644742	Saildrone
46	46.2	37.722821	-122.721340	Saildrone

H.   UCTD Stations

Waypoints for underway CTD (UCTD) deployments mapped in **Appendix A**. Station locations are approximately spaced 15-nmi apart and staggered on adjacent lines to improve sampling coverage. If the waypoints provided do no occur precisely on the acoustic transect, the OOD shall choose the point on the transect closest to the UCTD waypoint.

Name	Latitude	Longitude
UCTD001	32.740223	-117.321547
UCTD002	32.629110	-117.808117
UCTD003	32.328175	-118.170095
UCTD004	32.616946	-117.997114
UCTD005	32.843448	-117.530749
UCTD006	33.093659	-117.393350
UCTD007	32.869139	-117.857778
UCTD008	32.643527	-118.324302
UCTD009	32.904101	-118.180016
UCTD010	33.130507	-117.712881
UCTD011	33.337105	-117.663862
UCTD012	33.155394	-118.040075
UCTD013	32.961608	-118.440946
UCTD014	33.012854	-118.734211
UCTD015	33.203569	-118.339814
UCTD016	33.394071	-117.944236
UCTD017	33.177363	-118.780940
UCTD018	33.412850	-118.306125
UCTD019	33.565756	-117.988739
UCTD020	33.591691	-118.324618
UCTD021	33.408761	-118.702509
UCTD022	33.216187	-119.100993
UCTD023	33.274872	-119.388815
UCTD024	33.454961	-119.014787
UCTD025	33.652380	-118.604594

UCTD026	33.897239	-118.502267
UCTD027	33.705760	-118.901447
UCTD028	33.518890	-119.290797
UCTD029	33.539995	-119.659168
UCTD030	33.757210	-119.207497
UCTD031	33.943659	-118.819421
UCTD032	34.038817	-119.030980
UCTD033	33.802510	-119.524006
UCTD034	33.583252	-119.980047
UCTD035	33.635758	-120.262816
UCTD036	33.831529	-119.855295
UCTD037	34.025108	-119.450683
UCTD038	34.225632	-119.430319
UCTD039	34.083381	-119.727884
UCTD040	33.861611	-120.187785
UCTD041	33.900004	-120.497712
UCTD042	34.118656	-120.040464
UCTD043	34.290516	-119.680902
UCTD044	34.332111	-119.983203
UCTD045	34.134847	-120.396846
UCTD046	33.924263	-120.837602
UCTD047	33.973023	-121.134371
UCTD048	34.190829	-120.678559
UCTD049	34.411968	-120.215215
UCTD050	34.449189	-120.525382
UCTD051	34.247067	-120.948638
UCTD052	34.315623	-121.229678
UCTD053	34.493201	-120.856956
UCTD054	34.739147	-120.713199
UCTD055	34.558384	-121.093548
UCTD056	34.605928	-121.385881
UCTD057	34.790591	-120.997615
UCTD058	34.901527	-120.763897
UCTD059	35.110701	-120.735176
UCTD060	34.904967	-121.171022
UCTD061	34.704156	-121.595136
UCTD062	34.943420	-121.510163
UCTD063	35.156493	-121.059456
UCTD064	35.381396	-120.966942
UCTD065	35.199386	-121.353715
UCTD066	35.020347	-121.733482
UCTD067	35.263262	-121.644482
UCTD068	35.427373	-121.295555

UCTD069	35.628474	-121.286578
UCTD070	35.494216	-121.572033
UCTD071	35.352689	-121.872440
UCTD072	35.560273	-121.818417
UCTD073	35.700024	-121.521208
UCTD074	35.892677	-121.530097
UCTD075	35.771816	-121.787831
UCTD076	35.642231	-122.063865
UCTD077	35.843428	-122.029949
UCTD078	35.978185	-121.741709
UCTD079	36.150292	-121.794204
UCTD080	36.047624	-122.014253
UCTD081	35.931918	-122.261717
UCTD082	36.108375	-122.279225
UCTD083	36.246038	-121.984341
UCTD084	36.443432	-121.980669
UCTD085	36.325376	-122.235096
UCTD086	36.194125	-122.516997
UCTD087	36.432572	-122.442128
UCTD088	36.563601	-122.159924
UCTD089	36.703785	-121.857673
UCTD090	36.866369	-121.918052
UCTD091	36.760332	-122.147598
UCTD092	36.652975	-122.379310
UCTD093	36.718328	-122.639283
UCTD094	36.841199	-122.373384
UCTD095	36.927445	-122.186489
UCTD096	37.023929	-122.369689
UCTD097	36.913484	-122.608848
UCTD098	36.796571	-122.861456
UCTD099	37.005566	-122.844833
UCTD100	37.125296	-122.585424
UCTD101	37.355391	-122.520949
UCTD102	37.227834	-122.799112
UCTD103	37.104986	-123.066590
UCTD104	37.301106	-123.038064
UCTD105	37.435535	-122.744560
UCTD106	37.677167	-122.632706
UCTD107	37.517214	-122.983015
UCTD108	37.359642	-123.327351
UCTD109	37.732054	-123.354429
UCTD110	37.845867	-123.105442
UCTD111	37.954358	-122.866979

UCTD112	38.174895	-123.214099
UCTD113	38.073225	-123.438005
UCTD114	38.290569	-123.796248
UCTD115	38.399459	-123.555858
UCTD116	38.505048	-123.322188
UCTD117	38.741218	-123.652039
UCTD118	38.640674	-123.875600
UCTD119	38.532817	-124.114998
UCTD120	38.890228	-124.165973
UCTD121	38.992200	-123.938467
UCTD122	39.068332	-123.768643
UCTD123	39.329620	-124.017846
UCTD124	39.241861	-124.214849
UCTD125	39.152048	-124.415953
UCTD126	39.517092	-124.465164
UCTD127	39.600072	-124.278406
UCTD128	39.684453	-124.088473
UCTD129	39.759630	-123.918871
UCTD130	40.028689	-124.207935
UCTD131	39.915911	-124.462456
UCTD132	39.802415	-124.718168
UCTD133	40.034237	-125.033762
UCTD134	40.148585	-124.774356
UCTD135	40.262449	-124.515625
UCTD136	40.450654	-124.742984
UCTD137	40.450411	-125.036913
UCTD138	40.774805	-124.853101
UCTD139	40.774835	-124.583513
UCTD140	40.774844	-124.319382
UCTD141	41.089354	-124.445480
UCTD142	41.089364	-124.715335
UCTD143	41.419965	-124.926827
UCTD144	41.420100	-124.561186
UCTD145	41.420250	-124.194001
UCTD146	41.765238	-124.382868
UCTD147	41.765043	-124.742830
UCTD148	41.764835	-125.099516
UCTD149	42.093949	-124.913117
UCTD150	42.094108	-124.561983
UCTD151	42.427489	-124.554434
UCTD152	42.427376	-124.825887
UCTD153	42.427373	-125.107467
UCTD154	42.760969	-124.695331

UCTD155	42.760998	-124.981840
UCTD156	42.760965	-125.266121
UCTD157	42.927770	-125.101200
UCTD158	42.927792	-124.779859
UCTD159	43.094175	-124.520199
UCTD160	43.093967	-124.855297
UCTD161	43.094158	-125.188359
UCTD162	43.260969	-124.933564
UCTD163	43.260809	-124.618573
UCTD164	43.425763	-124.371906
UCTD165	43.425867	-124.694234
UCTD166	43.425996	-125.025873
UCTD167	43.598560	-125.177126
UCTD168	43.598474	-124.853437
UCTD169	43.598401	-124.529328
UCTD170	43.762091	-124.269569
UCTD171	43.761936	-124.755735
UCTD172	43.761702	-125.242300
UCTD173	43.927158	-125.001900
UCTD174	43.927060	-124.681202
UCTD175	43.927232	-124.362287
UCTD176	44.090193	-124.225756
UCTD177	44.090359	-124.580119
UCTD178	44.090571	-124.934628
UCTD179	44.255810	-125.156268
UCTD180	44.256041	-124.772722
UCTD181	44.256261	-124.398524
UCTD182	44.427513	-124.171172
UCTD183	44.427235	-124.684861
UCTD184	44.426938	-125.199243
UCTD185	44.593995	-124.914790
UCTD186	44.594225	-124.413960
UCTD187	44.760122	-124.163445
UCTD188	44.760063	-124.658948
UCTD189	44.759876	-125.151985
UCTD190	44.927462	-124.912466
UCTD191	44.927280	-124.417774
UCTD192	45.089551	-124.080157
UCTD193	45.089709	-124.650169
UCTD194	45.089803	-125.234099
UCTD195	45.257432	-124.934861
UCTD196	45.257668	-124.352393
UCTD197	45.419656	-124.060358

UCTD198	45.419927	-124.641386
UCTD199	45.420261	-125.215657
UCTD200	45.588062	-124.924858
UCTD201	45.588008	-124.316639
UCTD202	45.758058	-124.077516
UCTD203	45.758055	-124.631251
UCTD204	45.758047	-125.169492
UCTD205	45.925662	-124.916435
UCTD206	45.925668	-124.362778
UCTD207	46.086875	-124.070191
UCTD208	46.086868	-124.638616
UCTD209	46.086689	-125.194567
UCTD210	46.254818	-125.288238
UCTD211	46.254627	-124.759455
UCTD212	46.254318	-124.231129
UCTD213	46.421457	-124.471513
UCTD214	46.421499	-125.007038
UCTD215	46.583538	-125.209147
UCTD216	46.583613	-124.702518
UCTD217	46.583700	-124.197316
UCTD218	46.750262	-124.435629
UCTD219	46.750520	-124.963865
UCTD220	46.923346	-125.144421
UCTD221	46.923116	-124.705153
UCTD222	46.922962	-124.327862
UCTD223	47.095261	-124.510276
UCTD224	47.095265	-124.936445
UCTD225	47.095341	-125.360362
UCTD226	47.095187	-125.785205
UCTD227	47.258442	-125.935144
UCTD228	47.258088	-125.143348
UCTD229	47.257621	-124.350678
UCTD230	47.425547	-124.729771
UCTD231	47.425091	-125.541153
UCTD232	47.591951	-125.800488
UCTD233	47.591781	-125.176122
UCTD234	47.591521	-124.576828
UCTD235	47.763389	-124.852916
UCTD236	47.763749	-125.500514
UCTD237	47.763680	-126.157923
UCTD238	47.926088	-125.844716
UCTD239	47.926098	-125.186987
UCTD240	47.926077	-124.769368

UCTD241	48.093976	-124.984148
UCTD242	48.093785	-125.529531
UCTD243	48.093522	-126.156277
UCTD244	48.260578	-125.841557
UCTD245	48.260880	-125.267008
UCTD246	48.260795	-124.802091
UCTD247	48.381646	-125.009862
UCTD248	48.561363	-124.782188
UCTD249	48.651423	-124.995316
UCTD250	48.436163	-125.268622
UCTD251	48.411755	-125.627243
UCTD252	48.616746	-125.367620
UCTD253	48.799330	-125.482369
UCTD254	48.592547	-125.745264
UCTD255	48.382244	-126.011931
UCTD256	48.404716	-126.330599
UCTD257	48.612831	-126.066677
UCTD258	48.823172	-125.799126
UCTD259	48.967817	-125.928637
UCTD260	48.760503	-126.192666
UCTD261	48.555884	-126.452288
UCTD262	48.574377	-126.769074
UCTD263	48.782193	-126.504766
UCTD264	48.990502	-126.238913
UCTD265	49.184545	-126.321455
UCTD266	48.979209	-126.584167
UCTD267	48.772824	-126.847454
UCTD268	48.982745	-126.914614
UCTD269	49.192664	-126.646119
UCTD270	49.454166	-126.650610
UCTD271	49.232180	-126.936126
UCTD272	49.016552	-127.212471
UCTD273	49.245851	-127.251401
UCTD274	49.457956	-126.977737
UCTD275	49.689139	-127.023216
UCTD276	49.482568	-127.290359
UCTD277	49.272923	-127.561025
UCTD278	49.494643	-127.614066
UCTD279	49.702411	-127.344803
UCTD280	49.905337	-127.419992
UCTD281	49.699223	-127.687710
UCTD282	49.499929	-127.945739
UCTD283	49.700300	-128.021196

UCTD284	49.905956	-127.753653
UCTD285	50.041748	-127.915370
UCTD286	49.863670	-128.147937
UCTD287	49.683974	-128.381052
UCTD288	49.885535	-128.469763
UCTD289	50.072522	-128.225679
UCTD290	50.412879	-128.130152
UCTD291	50.259683	-128.331664
UCTD292	50.095834	-128.545979
UCTD293	50.116728	-128.851466
UCTD294	50.290140	-128.624502
UCTD295	50.457221	-128.405055
UCTD296	50.655226	-128.476970
UCTD297	50.496600	-128.686585
UCTD298	50.335758	-128.898018

I. DASBR Deployment Waypoints
    Waypoints for the DASBR deployments are mapped in **Appendix A**.

Name	Latitude	Longitude
1	48.349099	-126.713681
2	47.424700	-129.111000
3	46.254841	-125.364527
4	45.090000	-128.141000
5	44.090760	-125.250244
6	42.761100	-128.065000
7	41.419938	-125.020872
8	38.975100	-127.411000
9	38.790849	-124.379826
10	36.684200	-125.635000
11	36.171905	-122.564457
12	34.347100	-123.999000
13a	33.949662	-121.183105
13b	33.897721	-120.891872
14	32.303354	-118.221005

J.   Offshore Transit Waypoints
        Waypoints for the offshore transit at the beginning of the survey are mapped in **Appendix A**.

Transect	Waypoint	Latitude	Longitude	Type
0	0.1	37.799599	-122.519865	Transit
0	0.2	37.763413	-122.644529	Transit
0	0.3	37.787062	-122.810357	Transit
0	0.4	37.806460	-122.852771	Transit
0	0.5	37.908800	-124.825100	Transit
0	0.6	44.359400	-129.122200	Transit
0	0.7	50.642324	-128.470935	Transit

K.   Trawl Processing
Point of Contact: Sue Manion

TRAWL CATCH PROTOCOL

Standard trawl duration is 45 minutes.
  Reduction of duration only approved for
      1) marine mammal sighted during tow (any duration)
      2) presence of crab pots (but not less than 30 minute and if safely possible).

I. During trawl net retrieval:

only target CPS, mola, sharks, protected species, or humbolt squid falling on the deck or caught in mesh forward of the MMED will be collected and included as part of the total catch.

Protected species: Process and Release quickly if alive.

Remove and keep any gilled CPS. . If heads are missing don't include them in the random sample, but do include them in the remainder weight sample

Toss any other species forward of the MMED.

★Always process any marine mammals/turtles (per SWFSC MMPA research permit)

II. Total Catch General Procedure   2018 ATM survey:

A. Total catch ≤ 5 baskets
Empty trawl codend into baskets, white fish bin or outside sorting table.

1. All Target species **remove, sort and process** from entire catch:
   - Protected fish species (salmon and eulachon)
   - Target CPS (sardine, anchovy, Pacific and jack mackerel, market squid)
   - Minor target species (refer to attached list)

2. Other Taxa will be grouped and processed, code = 202423 (Animalia)

The Other Taxa (with market squid mixed in) will be adaptively sampled and processed when it is too difficult to remove and sort all market squid from catch.

B. Total catch > 5 baskets
Empty trawl codend into baskets, white fish bin or outside sorting table. Remove the sliding metal plate, and push the catch into baskets.

1. Remove <u>protected fish</u> species from the entire catch and process

2. Take a random 5 basket sample.

3. Weigh and record any unsorted baskets (remainder of total catch)

4. Sort and process CPS and minor target species from 5 basket sample only.

5. Other Taxa will be grouped and processed, code = 202423 (Animalia)

The Other Taxa (with market squid mixed in) will be adaptively sampled and processed when it is too difficult to remove and sort all market squid from catch.

III. Processing target CPS, sharks, and minor target (see list) species

- If a species catch is $\leq$ 50 individuals, process all specimens.
- If a species catch is >50 individuals, take a 50 random subsample, process, and record remainder weight of the species.

Refer to Target Species Biological Processing Chart and Bin Processing Chart for specific quantities needed.

IV. Processing Other Taxa (code = 202423 (Animalia))

Other taxa will not be sorted. **Exception**: In Oregon, counts mandatory for each species (or lowest taxa) present in addition to group weight.

1. Group all, weigh, and record total weight on catch form.
2. Record species (or lowest taxa) present.
3. Take picture(s) and record picture numbers.

V. Adaptive Sampling of Other Taxa (with market squid mixed in):

1. Take a random composition sample (gray or white tub)
2. Remove and process market squid
    i. if $\leq$50, process all
    ii. if > 50, take a 50 random subsample, process, and record remainder weight
    iii. weigh and record weight of Other Taxa of composition sample
    iv. record species (or lowest taxa) present
    v. take picture(s) and record picture numbers
3. Group unsorted other taxa and market squid from catch, weigh, and record

VI. Processing Protected fish (salmon and eulachon):
See Salmon/Eulachon SOP for processing instructions.

Note:
Salmon will be recorded as unidentified (code 161974)
Live salmon process first and release

Target Species Biological Processing Chart (no larval stages) **ATM 2018**

	Length Frequency	Group Weight (kg)	Length (mm)	Individual Weight (g)	Sex Maturity	Ovary Saved codes 2-4	Otolith	DNA	Remainder Weight (kg)	Body Disposition
Pacific sardine 161729	N/A	N/A	50 SL	50	50	0	50	50 (see SOP)	Yes	Discard
Northern anchovy* 161828	N/A	N/A	50 SL	50	25	0	25	50 (see SOP)	Yes	Discard
Pacific mackerel* 172412	N/A	N/A	50 FL	50	25	10	25	N/A	Yes	Discard
Jack mackerel* 168586	N/A	N/A	50 FL	50	25	0	25	N/A	Yes	Discard
Market squid ** 82371	N/A	N/A	50 ML	50	N/A	N/A	N/A	N/A	Yes	Discard
Minor target***	50	50	N/A	N/A	N/A	N/A	N/A	N/A	Yes	Discard

* see Bin charts below
** Market squid should be a random mixture (both large and small sizes)
*** Refer to Minor Target Species Chart

Bin Processing Chart for Anchovy proportion **25** fish over the 12 bin sizes   Bin size 20 mm

Bin #	1	2	3	4	5	6	7	8	9	10	11	12
Bin start	40	51	71	91	111	131	151	171	191	211	231	>=251
Bin end	50	70	90	110	130	150	170	190	210	230	250	

● record sex and maturity, and take otoliths for the 25 bin selected fish
● no ovaries saved

Bin Processing Chart for Mackerels proportion **25** fish over the 12 bin sizes   Bin size 50 mm

Bin #	1	2	3	4	5	6	7	8	9	10	11	12
Bin start	31	51	101	151	201	251	301	351	401	451	501	> =551
Bin end	50	100	150	200	250	300	350	400	450	500	550	

● record sex and maturity, and take otoliths for the 25 bin selected fish
● **Pac. mackerel:** up to 10 ovaries (visual maturity codes 2-4) will be removed from the 25 selected fish. Preserve whole ovaries in pint jars of active or hydrated (codes 3, 4) & a piece in a cassette of intermediate (code 2) ovaries (if no females in 25 then # ovary saved = 0)

Minor Target Species Chart:
Use FL for Length Frequency except where noted in red

Scientific Name	Common Name	Itis tsn
Alosa sapidissima	American shad	161702
Atherinopsis californiensis	jacksmelt	166012
Brama japonica	Pacific pomfret	170289
Clupea pallasii	Pacific herring	551209
Cololabis saira	Pacific saury	165609
Hypomesus pretiosus	surf smelt	162030
Mallotus villosus	capelin	162035
Merluccius productus (>110mm)	Pacific hake or whiting (>110mm)	164792
Mola TL	ocean sunfish	173414
Peprilus simillimus	Pacific butterfish or pompano	172565
Sarda chiliensis	Pacific bonito	172408
(identify species of adult rockfish)	(name) rockfish	code#
Sphyraena argentea	Pacific barracuda (CA barracuda)	170426
Alopias vulpinus	thresher shark	159916
Prionace glauca	blue shark	160424
Squalus acanthias	spiny dogfish	160617
Torpedo californica TL	Pacific torpedo ray	160833
Dasyatis violacea TL	pelagic stingray	160950
Myliobatis california TL	bat ray	160981
Hydrolagus colliei TL	spotted ratfish	161015
Thunnus alaunga	albacore	172419
Dosidicus gigas **length not measured**	humbolt squid	82538
Scyphozoa **length not measured**	Group & weigh the following jellyfish: eggyolk , moon, and chrysaora	40500

LABELs
Salmon fin-clip sample IDs are sequential unique #s for each cruise and ship beginning at 001
(e.g. 1807RL001, 1807RL002, ….)

QR codes with 00000000xxxx are only for females with ovaries saved (a label for cassette,
ovary jar, specimen sheet, and if otoliths are removed its associated otolith micro-tube)

QR codes with A000000xxxxx are for any fish whose otoliths are removed but no ovaries saved.
The QR number is abbreviated (Axxxxx) and written on specimen sheet.

Frozen fish/squid will always have a **frozen bag label** filled out. (for one or more species)
   Individuals to be frozen with a recorded L&W will be individually bagged and have a ticket
     ID; then the bagged individuals can be put in a group bag.

L.   Marine Mammal and Sea Turtle Incidental Take and Sampling Documents
        Point of Contact: SWFSC Environmental Compliance Specialist (SWFSC.ITA@noaa.gov)

        All of the marine mammal sampling protocols are available for download by NOAA employees from the SWFSC EC/ITA Document Repository (https://drive.google.com/drive/folders/0BxKoDRm1QXQ5NVRMUjFBYVN0Tnc).

        Specific documents mentioned above:

        PSIT-002.02 - Marine Mammal & Sea Turtle Sampling Protocol

        (https://drive.google.com/a/noaa.gov/file/d/0BxKoDRm1QXQ5Unh0Q2o4eTJ3TmM/view?usp=sharing)

        PSIT-004.02 SWFSC Marine Mammal Handling Protocol

        (https://drive.google.com/a/noaa.gov/file/d/0BxKoDRm1QXQ5NXUxRVJYMEd2eWM/view?usp=sharing)
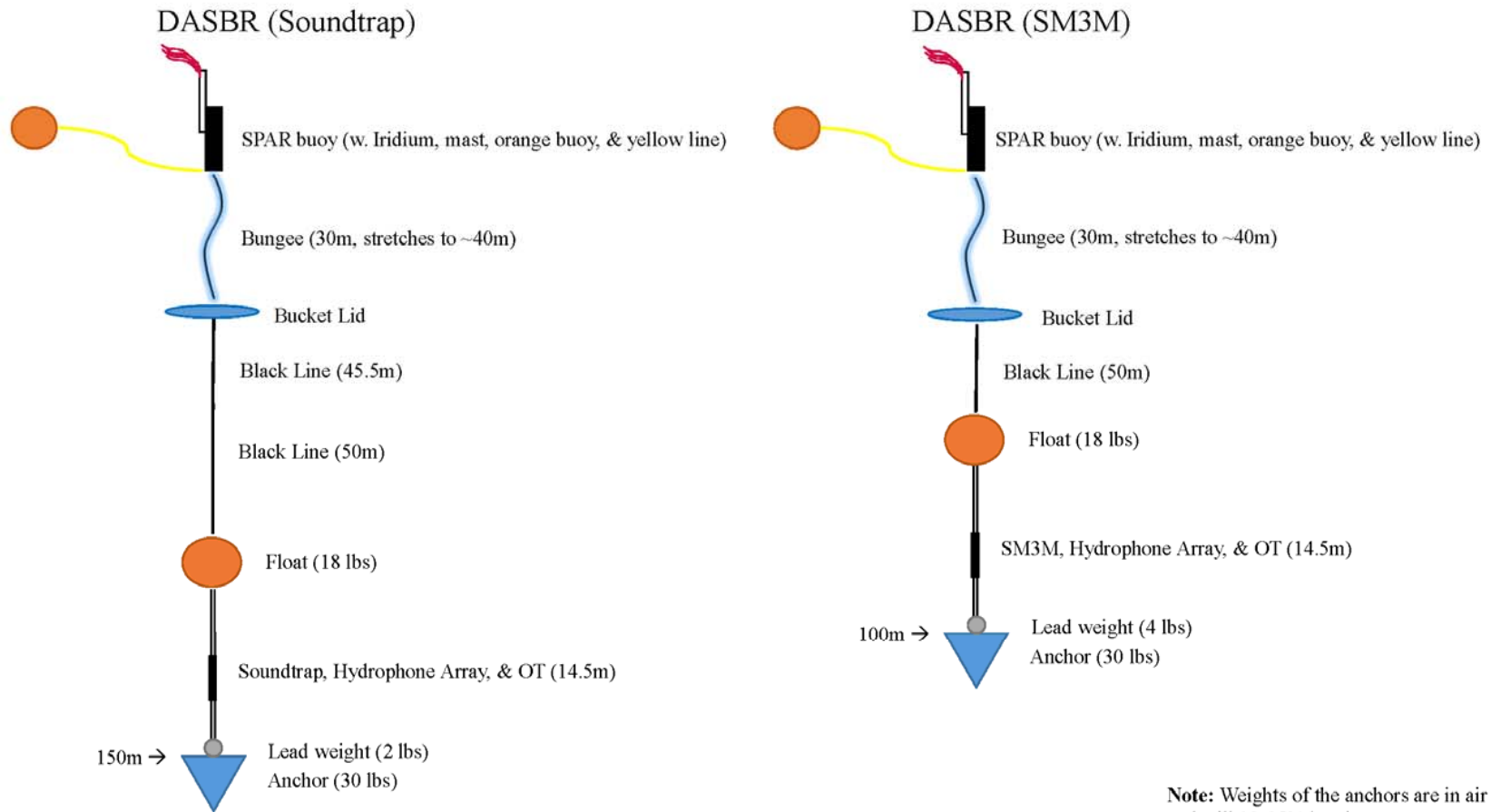
        PSIT-005.01 PIRO Protected Species Handling Protocol

        (https://drive.google.com/a/noaa.gov/file/d/0BxKoDRm1QXQ5VEJQZzlPOV9oTGM/view?usp=sharing)

        List of Authorized Take Species for SWFSC Trawl Surveys

        (https://drive.google.com/file/d/0BxKoDRm1QXQ5eDF2aEZfSHdOZzg/view)

M.   DASBR diagram

DASBR (Soundtrap)

SPAR buoy (w. Iridium, mast, orange buoy, & yellow line)

Bungee (30m, stretches to ~40m)

Bucket Lid

Black Line (45.5m)

Black Line (50m)

Float (18 lbs)

Soundtrap, Hydrophone Array, & OT (14.5m)

150m → Lead weight (2 lbs)
Anchor (30 lbs)

DASBR (SM3M)

SPAR buoy (w. Iridium, mast, orange buoy, & yellow line)

Bungee (30m, stretches to ~40m)

Bucket Lid

Black Line (50m)

Float (18 lbs)

SM3M, Hydrophone Array, & OT (14.5m)

100m → Lead weight (4 lbs)
Anchor (30 lbs)

Note: Weights of the anchors are in air
and will 10-15% less in water.

N. DASBR Deployment and Retrieval Instructions

INTRODUCTION

Drifting Acoustic Spar Buoy Recorders (DASBRs) include two main types: SoundTraps (150 m) and SM3M (100 m). Deployment/retrieval occurs at specific locations, and therefore may occur at various times of day or night. This requires that preparation for deployment/retrieval should be considered ~ 1 day prior to the activity.

- **Black Spar Buoy**. The spar buoys are made of black ABS plastic and have a subsurface recorder (a Wildlife Acoustics SM3M 2-channel recorder or a SoundTrap 4300 4-channel recorder). They are labeled #B1-15, where 'B' is for black, and the #s are the buoy #s. Lines are stored in plastic buckets.
- **Satellite Tracker- Iridium**. All DASBRs have an Iridium geo-locator devices in their spar buoys that each transmit GPS locations every 2 hours.
- **Bucket**. Bucket contains lid, line, bungee, and (for some) hydrophone arrays.
- **Anchor**. A 30-lb mushroom anchor is attached to reduce the movement of the array in rough seas.
- **Bungees**. Black DASBRs have a 30-m section of 3/8" bungee immediately below the buoy, again to reduce movement of the hydrophones.
- **Hydrophones**. All DASBRs have two hydrophones configured as a vertical array with 10-m separation at 100 m depth. Hydrophones are stored in buckets (for Black DASBRs using SoundTrap recorders), or in SM3M crates (for Black DASBRs using SM3M recorders).
- **Depth/Tilt Sensors**. Some of the Black DASBRs have a depth and tilt sensor (Loggerhead OpenTag) attached immediately below the lower hydrophone. All SoundTrap recorders have an internal tilt sensor but not a depth sensor.

DEPLOYMENT

Make sure that all personnel involved with deployment (including scientists, deck crew, and officers) have a clear idea of the deployment procedure and their roles. Have a meeting with the bos'n, deck crew, and officers who will be on watch before attempting any deployments. Remember that personnel safety is the highest priority. Equipment can be replaced. Make sure the bridge crew knows **to never back down when line is in the water**. During deployments, ask for one deck crew to be stationed next to you to relay messages to the bridge. Experience has shown that the safest way to deploy is off the stern while the vessel is moving forward slowly. Resist any suggestion that you deploy mid-ship, explain that there will be loose line in the water that will be sucked into the props.

Each type of DASBR has its own deployment protocol. Equipment cannot be dropped or thrown into the water without damage. Lower equipment carefully using lines. This includes the anchor weight; the weight will crack the bucket lid if dropped. Only the orange buoy can be tossed in the water.

Black DASBRs with SoundTrap Recorders

These are the lightest and easiest to deploy.

- **Meeting**. Meet w/ officers, crew, etc. to discuss protocol for deploying buoy off the stern. Identify person responsible for deck communications, and ideally an independent person to deploy.

- **Prep Gear on Back Deck**. Ensure that all gear is secured in place (spar buoy, mast, float, bungee, bucket, array w/ SoundTrap, and lid w/ anchor. Make sure there are no loops or tangles. ATTACH WEIGHT TO YELLOW FLOAT LINE WITH LIFESAVER.
- **Double check that SoundTrap in ON (see buoy preparation guide)**.
- **Dead Slow & Wind at Ship's Beam**. As you approach the deployment site, ask the officers to bring the ship to dead slow and to tell you by radio when they reach 1-2 kn speed. If possible, have the wind at the beam (to help blow the float away from the spar buoy & mast).
- **Anchor Ready**. Have one person hold onto the line w/ the anchor, and lower until the weight is over the water but close to railing level. Use an extra black line to loop through the anchor as a leash. They should not lower the buoy into the water until all of the line is paid out.
- **Lower Spar Buoy**. Once the ship is at dead slow, one scientist should lower the black DASBR buoy into the water using the **Yellow** line. [The DASBR will lie horizontally until the anchor applies tension to the line.] Throw out the orange buoy **downwind** of the spar buoy so that its line does not tangle with the DASBR's mast. Hold the bungee and do your best to guide the spar buoy such that the float line does not entangle with the mast. Hopefully, the weight on the yellow line will lower it in the water below the level of the mast, and the wind will blow the float away from the spar buoy.
- **Pay out Line**. Pay out line (first bungee cord and then ¼" black nylon line) only as fast as the vessel moves away from the buoy (avoid loose line in the water that could get sucked into the propellers). A second scientist can lower the anchor and hydrophone array over the side until it is just above the water's surface, but should not lower it into the water until all the line is paid out. Once all the line is paid out, the anchor can be lowered and the array released- but try to not let the recorder splat into the water.
- **Confirm Spar Buoy Stays Upright**. As the anchor sinks, it will help the spar buoy float vertically. Confirm that this happens. This is easier done in daylight, of course.
- **Enter Deployment in PAMGuard**. It will be a few minutes late, but that is ok (the overall locations will use the satellite data). Check on the SPOT devices to ensure that you are receiving updates on those buoys.

Special instructions for Black DASBRs with Wildlife Acoustics SM3M Recorders

The SM3M recorders are heavy and harder to deploy. Plan ahead and have at least **two** scientists available for first deployment.

- **Lower SM3M recorders on a line looped through the stainless-steel cage on top.** The recorder will float when it is in the water. Remove loop of line by letting go of one end. Otherwise, deploy as with SoundTrap recorders.

RETRIEVAL

Make sure that all personnel involved with retrieval (including scientists, deck crew, and officers) have a clear idea of the procedure and their roles. Have a meeting with deck crew and officers who will be on watch before attempting any retrieval. Remember that personnel safety is the highest priority. Equipment can be replaced. Wear gloves. During retrievals, ask for one deck crew to be stationed next to you to relay messages to the bridge.

You will need to work with the deck crew to establish the best method of grappling for the line between the spar buoys and the orange floats. The best retrieval location may be from a mid-ship station, but extreme care is needed to ensure that the vessel does not drift over the top of the line. Try approaching slowly from an upwind direction (going downwind). Toss the grappling hook and snag the **Yellow** floating line. Ask the vessel to turn broadside to the wind with the buoy on the upwind side of the vessel, so that you will drift away from the buoy.

In rough weather, it might not be practical to turn broadside to wind and waves. The alternative is to approach in an upwind direction and to maintain station next to the buoy as it is retrieved. This requires a more skilled vessel operator to avoid the wind catching the bow and pushing the ship over the top of the line being retrieved. If the officer in charge is inexperienced, it may be better to ask the Captain to intervene or just to wait until a more skilled officer is on watch.

It is very important not to cleat-off the line on the grappling hook. The full force of the ship pulling on the line is likely to break the bungee cord and result in loss of equipment and data. I have provided a bucket with 1000 ft of ¼" nylon line to attach to the grappling hook. Attach a float on the other end of the ¼" line in case it is necessary to let go of the grappling hook line. Pay out this line if you cannot easily hold it by hand. When the ship has come to a stop, one or two people should be able to pull in the line.

- **Ship approaches last known location.** Give bridge last Iridium location so they can position ship to intercept buoy.
- **Prepare ahead and have two scientists for every retrieval.** Have three scientists to retrieve White DASBRs.
- **Aid in location of buoy using binoculars.** The buoys can be located easily using big-eyes during daylight hours. If flashers are working, buoys can be located at night with hand-held binoculars. If flashers have failed, use spotlight (the ship's or spare scientist spotlight) to illuminate reflective tape.
- **Grapple for the Yellow floating line.** Do not cleat-off the grappling hook.
- **Retrieve the grappling hook, orange float, and Yellow line**. Pulling by hand with gloves.
- **Bring spar buoy aboard.** Lift over rail and set on deck.
- **Retrieve bungee cord, then black ¼" line, then hydrophone array.** Hold hydrophone array away from vessel lip as you are retrieving it. Avoid bumping the hydrophone elements against the ship. Lift the recorders gently over the rail.
- **Retrieve anchor**.
- **Restack in bucket after retrieval.**
- **Wash, clean and dry all equipment.** Remove any marine fouling and rinse everything with fresh water. White buckets have drain holes in the bottom, so you can fill them with fresh water and they will drain. Stack line on a dry deck in the sun to dry. Return recorders to their storage case

O.	Nearshore-sampling Lander Diagram

A tollgate at Point Conception, along CalCOFI Line 80 (left), will be sampled continuously by a Saildrone and two instrumented moorings (CCE1 and CCE2; middle), periodically by gliders, and seasonally by ships. A lander will be deployed at ~100-m depth along Line 80 (34.4388, 120.5472) to continuously sample any fish migrating close to shore. The lander includes an autonomous wideband echosounder (Simrad WBAT, yellow) with 55-95 kHz transducer (Simrad ES70-18CD, red); a passive acoustic logger (Multielectronique Aural M2, white); a 300 kHz ADCP (Teledyne RDI Workhorse Monitor, not shown); a UHMW backplane with four floats; two acoustic releases (yellow and black); and a ~150 kg ballast (steel chain links). The backplane with instruments is ~ 2-m long, 1-m wide, and ~0.5-m thick.